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EG &G Idaho, Inc.
August 1988

Geotechnical Report
Army Materials Technology Laboratory
Watertown, Massachusetts

Arthur D. Little, Inc.
Center for Environmental Assurance
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Weston Geophysical Corp.

GEOTECHNICAL REPORT

Army Materials Technology Laboratory
Watertown, Massachusetts

August, 1988

Prepared For

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ABSTRACT

As part of the remedial investigation and feasibility study being conducted at the Army Materials Technology Laboratory in Watertown, Massachusetts, Arthur D. Little, Inc., conducted a program of physical characterization and sampling of the site. The geology and hydrology of the site was summarized using data from 17 soil borings, one of which was cored 15 feet into bedrock, physical testing of soil samples, water level measurements and determination of in situ hydraulic conductivity from 16 monitor wells, a seismic refraction survey to determine depth to bedrock and stratigraphic variation, and two borehole geophysical surveys.

Bedrock at the site consists of the Pennsylvanian Cambridge Argillite, a dense, finely laminated siltstone. The siltstone is overlain by a basal, bouldery till with a gray green, silt-rich sandy to gravelly matrix. Laying on top of the till is a laminated, silty sand found across the site, which is composed of moderately well sorted, very fine to fine-grained sand, with a clayey-silty matrix. Overlying the silty sand is a texturally variable layer of medium to coarse-grained sand and gravel, which is not found over the entire site. It is absent in the northwest corner of the site and grades to a gravelly sand eastward. The coarser sand-gravel unit is generally overlain by fill of disturbed gravel with exotic debris (concrete, brick, ceramic, etc.).

Surface run-off across the site is to the south, toward the Charles River, which is within 100-400 feet of the site. Groundwater flow, estimated by water level data, is to the south. The gradient averages 0.03 across the site, but in the southeast corner it decreases to 0.003. In situ hydraulic conductivities (k) were determined by falling head and rising head tests. For the silty sand, k ranges from 7.06×10^{-4} to 1.30×10^{-2} cm/sec and averages 6.4×10^{-3} cm/sec. For the coarser sandy gravel, k ranges from 4.24×10^{-3} to 3.30×10^{-2} cm/sec, averaging 2.7×10^{-2} cm/sec. From a packed pressure test, k for the argillite was found to average 4.1×10^{-7} m/sec. The flow rate through the site was calculated to be 0.016 m^3/sec (98 gpm). Estimated flow velocities vary from 6.4×10^{-4} cm/sec (142 m/yr) to 4.5×10^{-5} cm/sec (14.2 m/yr) where 4.5×10^{-4} cm/sec is most representative.

CONTENTS (continued)

CONTENTS (continued)

TABLES

FIGURES

1.0 BACKGROUND

The U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) has contracted with the Department of Energy-Idaho Operations Office to conduct a Remedial Investigation and Feasibility Study (RI/FS) at the Army Materials Technology Laboratory (AMTL) in Watertown, Massachusetts. The objective of the RI/FS is to characterize the extent to which hazardous materials may have contaminated the environment and to evaluate appropriate remedial alternatives. To complete the RI/FS, the Department of Energy, through their contractor, EG&G Idaho, Inc., has subcontracted Arthur D. Little, Inc., to perform physical characterization and sampling of the site. Specific tasks assigned to Arthur D. Little, Inc., included:

(a) Obtaining all permits, approvals, and licenses required by federal, state, local, USATHAMA, and AMTL authorities to perform the requested services.

(b) Performing a seismic refraction survey to map depth to bedrock at the AMTL.

(c) Drilling of three holes 10 feet into bedrock and installation of monitor wells.

(d) Drilling of 14 holes approximately ten feet into the water table and installation of monitor wells.

(e) Collection of soil samples at 5-foot intervals.

(f) Monitoring of drill cuttings, all samples and all wastes for organic vapors, flammability and radioactivity.

(g) Development of all wells completed.

(h) Hydraulic testing of all wells completed.

(i) Geophysical borehole logging of the three holes drilled into bedrock.

(j) Collection of soil samples for chemical analysis (one per hole, two in MW-3).

(k) Physical testing of approximately 20% of the soil samples collected for Atterberg limits, bulk density, specific gravity, porosity, hydraulic conductivity, and sieve grain size distribution.

(l) Collection of water samples from each completed well for chemical analysis.

(m) Measurement of water levels in all completed wells and at one location on the Charles River.

(n) Surveying locations and elevation of all completed wells.

(o) Entering all appropriate data into the USATHAMA Data Management System.

(p) Documenting all data in a final report.

All of the above tasks were successfully accomplished except for modifications in the core holes. Hole C03 was cored 15 feet into bedrock and abandoned after hydraulic testing, on request of EG&G Idaho, Inc. Hole C02 was prematurely terminated because of high volatile organic and explosivity measurements, on the advice of Arthur D. Little, Inc., with concurrence by EG&G, Idaho. Hole C03 was terminated in the basal till rather than cored into bedrock at EG&G Idaho's request.

Prior to commencing work at the AMTL, Arthur D. Little, Inc., prepared a Health and Safety Plan, a Quality Control Plan and a Sampling Plan. These plans were approved by EG&G Idaho, Inc., and detailed our procedures for site safety, operating procedures and quality objectives for site activities, and sampling procedures. During the entire period of the program, quality objectives and performance were audited by Arthur D. Little's Quality Control Manager and, during activity on site, safety procedures were monitored by Arthur D. Little's Health and Safety Manager.

2.0 REGIONAL GEOLOGY

2.1 Site Location

The Army Materials Technology Laboratory is located in Watertown, Massachusetts, about six miles west of Boston (Figure 1). The facility currently occupies approximately 35 acres on the north bank of the Charles River and includes ten major structures used for research and development, testing, and manufacturing.

2.2 Bedrock Geology

The AMTL facility is located within the north central portion of the Boston Basin, a topographic and structural basin bounded on the north and northwest by the North Boundary Thrust Fault, on the west by normal faulting and to the south by the Blue Hills and Ponkapoag Thrust Faults (Figure 2). To the southwest, intricate thrusting and tight, east plunging folds complicate the margin. The eastern margin of the basin is beneath Massachusetts Bay (Billings, 1976). Topographically the basin is bounded by low hills to the north, west, and south.

The basin is a structurally bounded depression in Precambrian basement filled with younger Mississippian and Pennsylvanian rocks (LaForge, 1932; Billings, 1976 and Kaye, 1980). At the southwest margin of the basin, the Precambrian basement outcrops in the cores of northeast plunging anticlines. To the south, between the Ponkapoag and Blue Hills Thrust Faults, the basin is intruded by the peralkaline Blue Hills Complex of Cambrian-Devorian age. The Blue Hills complex includes the Quincy Granite and other felsic intrusions. In the southwest portion of the basin, altered felsic and basaltic volcanics of the Mississippian Mattapan Complex are exposed. Volcanics of similar composition assigned to the Mississippian Lynn Complex are exposed north of the Northern Boundary Fault. Both volcanic complexes crosscut the Precambrian basement and are included as clasts in the Pennsylvanian Boston Bay Group (LaForge, 1932).

The Boston Bay Group consists of two formations, the lower Roxbury conglomerate and the upper Cambridge Argillite. LaForge (1932) subdivided the Roxbury Congolomerate into three members, the Squantum, Dorchester, and Brookline members. In general, the Roxbury Conglomerate outcrops south of the Charles River over the southern portion of the basin, and the Cambridge Argillite outcrops north of the Charles River.

The Cambridge Argillite is typically a varved or rhythmically layered, indurated siltstone. Beds range in thickness from 0.1 to 8 cm, and vary from dark gray clay to silt-rich layers to light gray very fine to fine-grained sand layers. Graded beds, cross beds, ripple marks, and slump structures are observed.

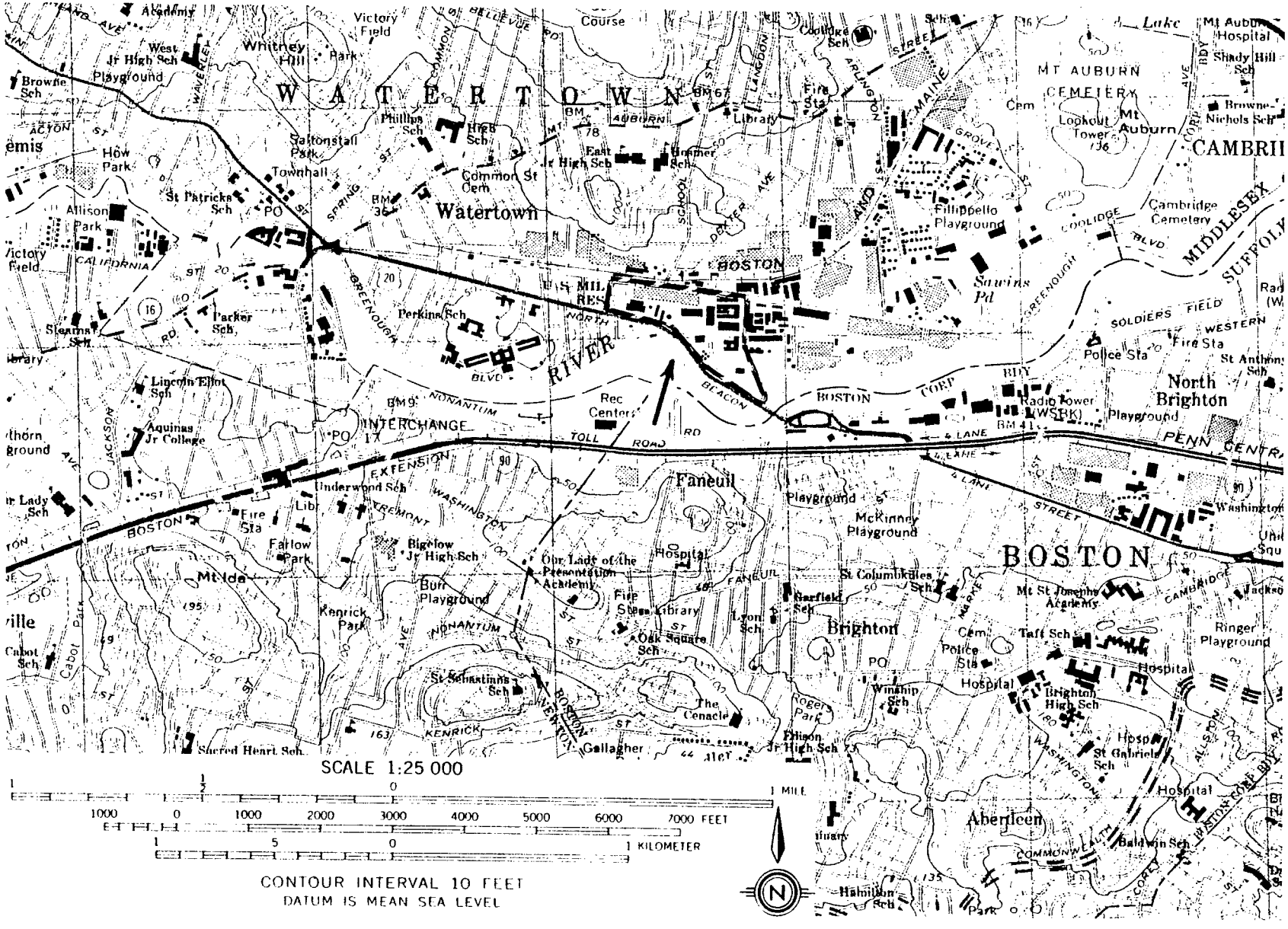


FIGURE 1. LOCATION OF ARMY MATERIALS TECHNOLOGY LABORATORY, WATERTOWN, MASSACHUSETTS.

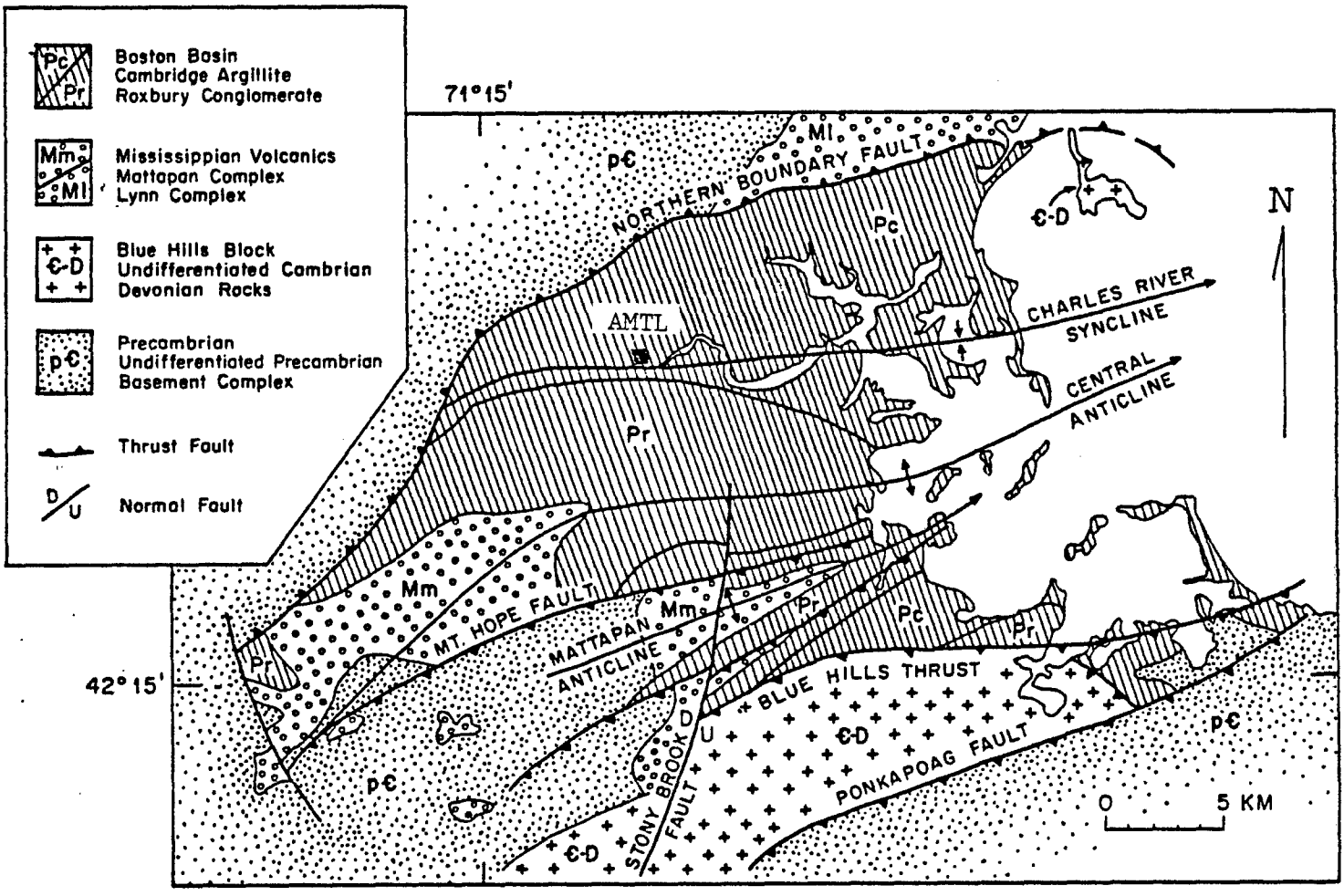


FIGURE 2. GENERAL GEOLOGY OF THE BOSTON BASIN.
(After Billings, 1976)

2.3 Structural Geology

The internal structure of the Boston Basin consists of a series of broad folds, plunging gently to the northeast or east (Billings, 1976). The AMTL facility is located on the axis of the Charles River Syncline (Figure 2). Most of the fault zones in the basin, including the bounding thrust faults, trend east-northeast. The only major exceptions to this are the Stony Brook Fault and an unnamed fault at the southwest margin of the basin, which are both normal faults and trend north-northeast and north-northwest, respectively. The Stony Brook Fault is mapped from Fresh Pond, approximately two miles east of the AMTL, south-southwest for approximately 20 miles.

2.4 Quarternary Geology

Numerous glacial advances and retreats in the vicinity of the Boston basin from 2 million years to 12,000 years ago have left a complex stratigraphic sequence of till, clay, and gravel. In general, the Quaternary aged deposits in the Boston Basin consist of (in ascending order) a basal till overlaying the bedrock, 0 to 70 feet thick, a marine clay, 0 to 60 feet thick, and outwash deposits of sand and gravel, 0 to 50 feet thick. General properties of the basal till and outwash deposits for the Boston area are summarized in Table 1.

TABLE 1. GENERAL PROPERTIES OF BASAL TILL AND OUTWASH DEPOSITS IN THE BOSTON AREA (After Hatheway, 1982)

Characteristic	Lodgement (Basal) Till	Outwash
Particle Size Gradation	Well graded; very heterogeneous	Gap-graded/poorly sorted semi-homogeneous
Presence of Boulders	Many, including erratics	Few to none
Percent (-) 200 Sieve	20-60	0-10
Percent (-) 0.02 mm	5-30	0-5
Effect of Fines	Governs engineering properties	Nil
Relative Density	Stiff - hard	Loose - moderately compact
Particle Shape	Angular-subangular	Subangular-rounded
Liquid Limit (%)	15-30	Non-plastic
Plasticity Index	0-20	Non-plastic
Standard Penetration (blows)	20-200+	0-20+
Cohesion (KN/m^2)	0-25	approx. 0
Friction Angle (°)	15-33	25-45
Consolidation Ratio	Overconsolidated	Normal to underconsolidated
Permeability (in situ) (cm/sec)	10^{-5} to 10^{-9}	10^{-2} to 10^{-5}

3.0 SITE GEOLOGY

3.1 Site Location

The Army Materials Technology Laboratory is located in Watertown, Massachusetts, on the north bank of the Charles River (Figure 1.) The site and surrounding area is generally flat, decreasing in elevation (National Geodetic Vertical Datum, 1929) from approximately 36 feet at the north to approximately 2.4 feet river elevation at the south (Figure 3). Almost the entire AMTL facility is situated on a low bluff, approximately 20 to 28 feet.

The present AMTL facility covers approximately 47.5 acres bounded by Arsenal Street on the north, North Beacon Street to the south, commercial property to the west, and a park to the east. The 55 acres immediately to the east of the present facility were part of the AMTL prior to 1968. This area now accommodates a park, a condominium complex, and retail stores (the Arsenal Mall). North of the facility there are commercial and light industrial properties. To the south, between North Beacon Street and the Charles River, are approximately 11 acres of former AMTL property which now accommodate a marina and park.

There are no known streams or natural drainages emptying to the Charles River in the vicinity of the AMTL. All surface run-off is collected in the storm drain network and discharged to the river.

The locations of the holes bored at AMTL during this study are shown in Figure 4. Two geologic cross sections, oriented approximately northwest-southeast are presented in Figures 5 and 6. The boring logs are found in Appendix A.

3.2 Bedrock Geology

The AMTL facility is underlain by siltstone of the Pennsylvanian Cambridge Argillite. The siltstone was encountered at a depth of 61.5 feet in hole C01, at the northwest corner of the facility. At this location, the siltstone was very finely laminated with dark bluish gray silt to clay beds and light bluish gray, very fine to fine grained sandy graded beds.

Occasional tensional fractures of approximately one to two inches in length were filled with quartz. Only a few fractures parallel to bedding and most cutting bedding contained thin films of red brown iron oxide which suggests a pre-existing open network of fractures which allowed circulating groundwater to oxidize, transport and redeposit iron. Most fractures were parallel to bedding (about 30° to 45° to core axis) and may have resulted from drilling since they contain no iron oxide film.

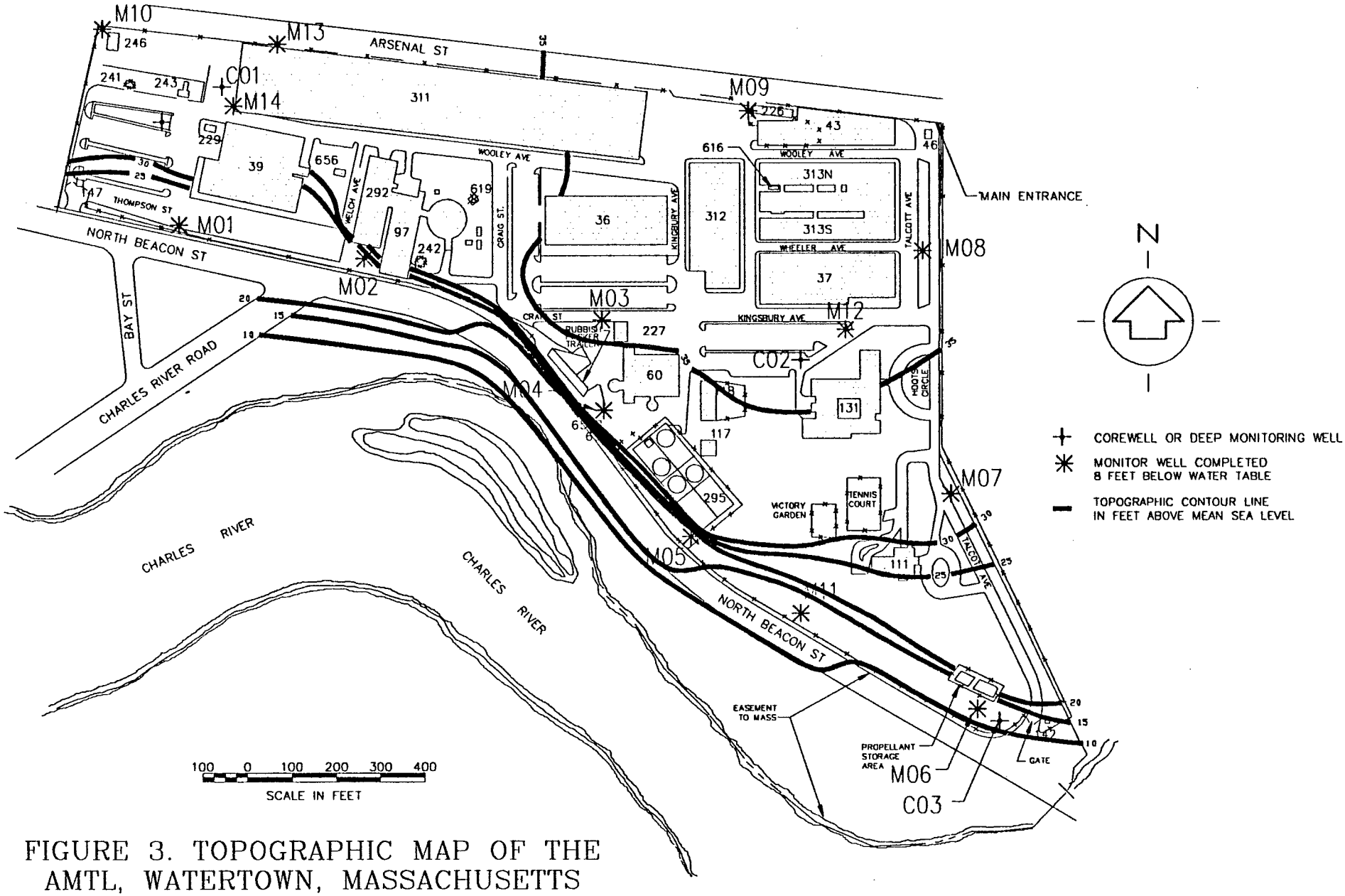


FIGURE 3. TOPOGRAPHIC MAP OF THE AMTL, WATERTOWN, MASSACHUSETTS

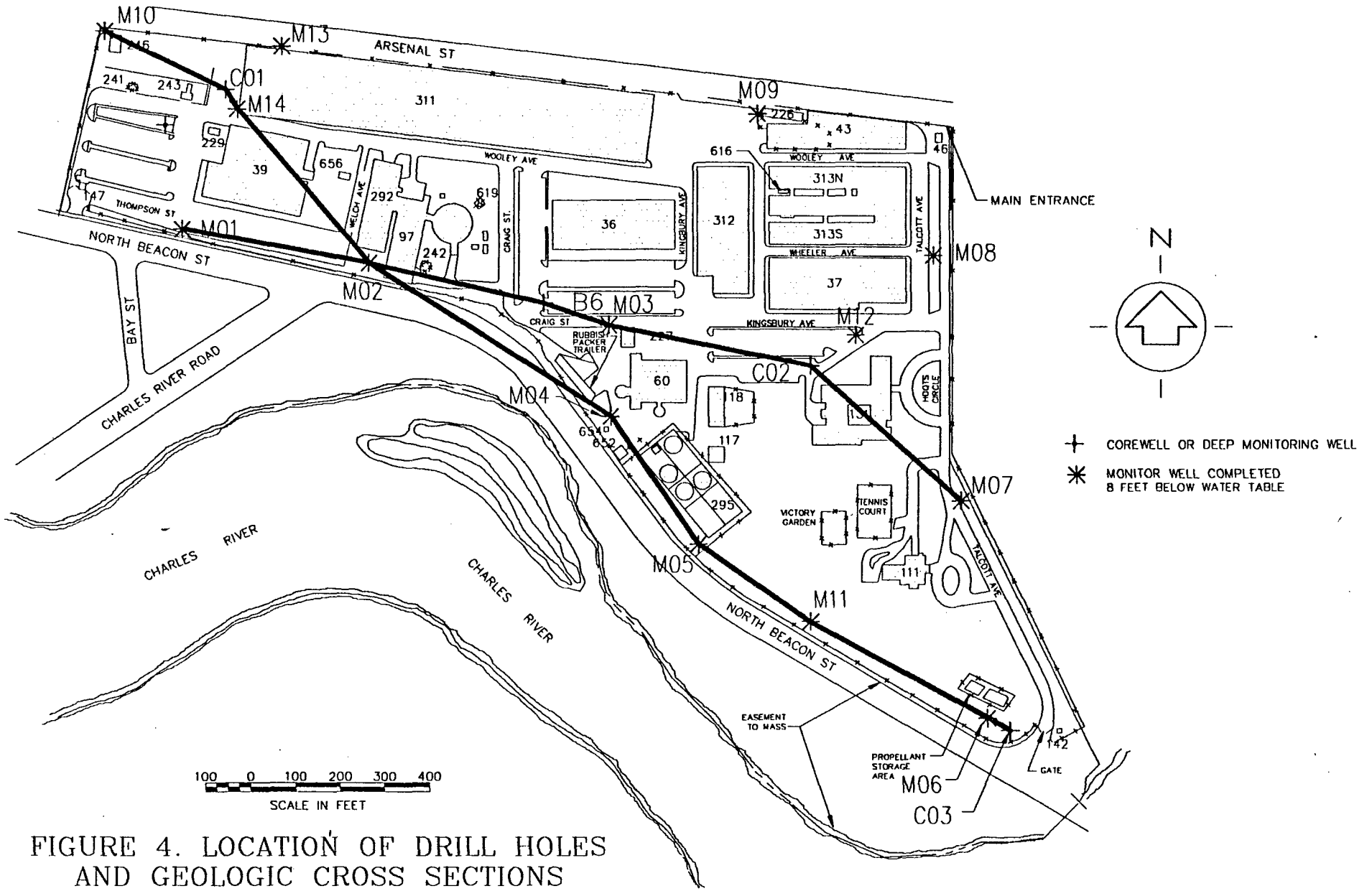


FIGURE 4. LOCATION OF DRILL HOLES AND GEOLOGIC CROSS SECTIONS

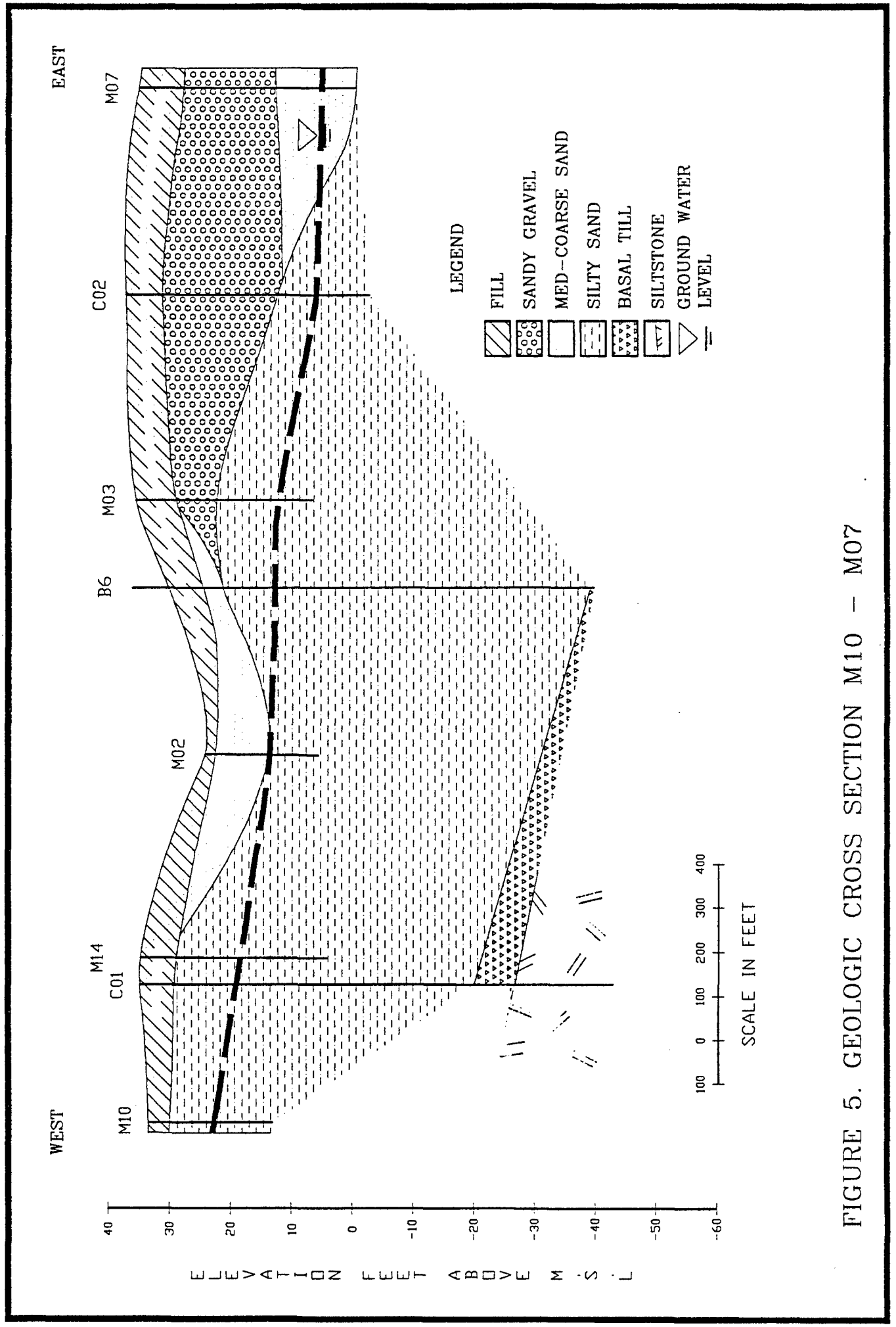


FIGURE 5. GEOLOGIC CROSS SECTION M10 – M07

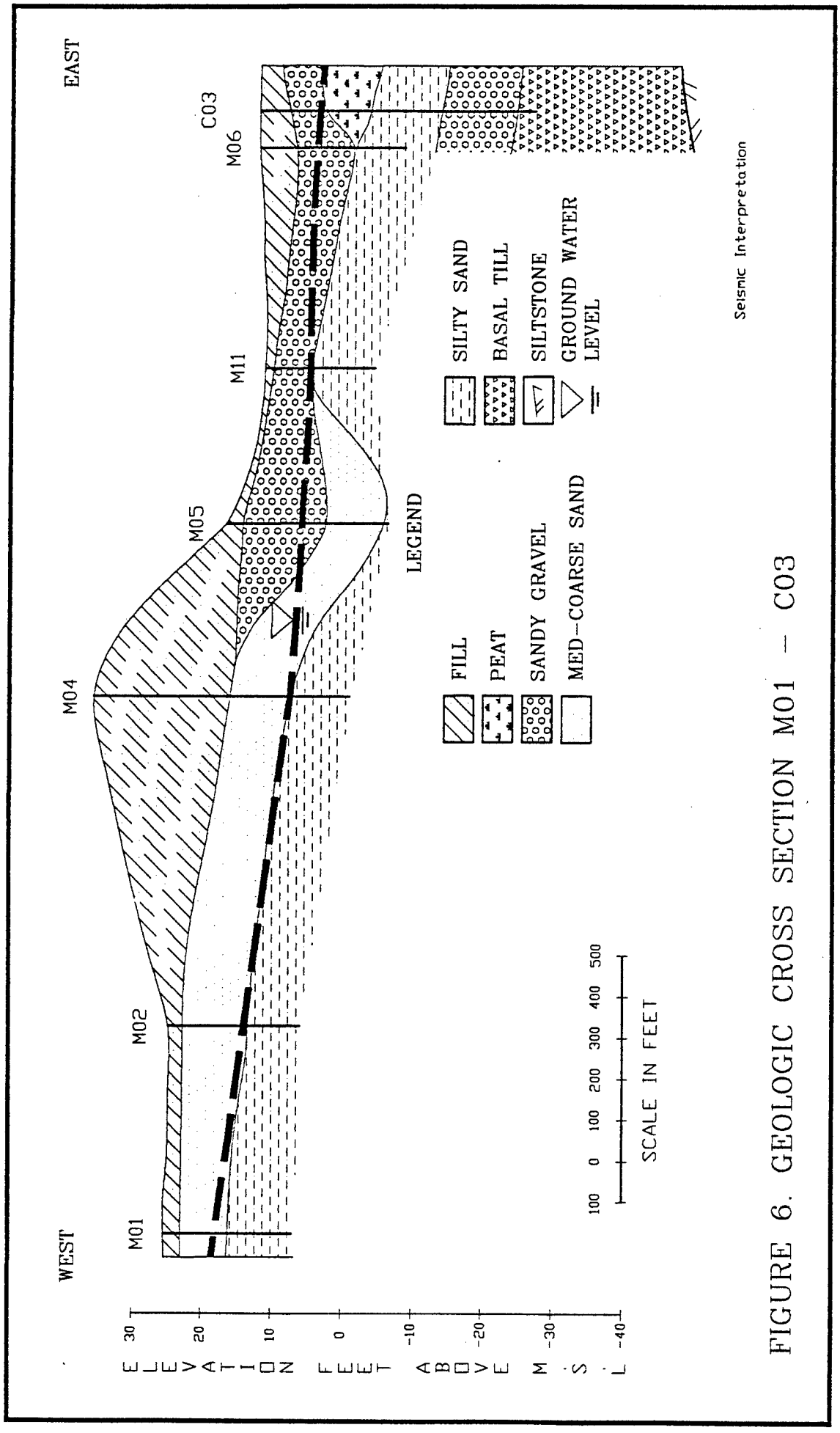


FIGURE 6. GEOLOGIC CROSS SECTION M01 – C03

Observation of joints in a nearby outcrop, approximately 1¼ miles southwest of the facility, indicates three broad orientations:

(a) parallel to bedding, oriented approximately east-west, dipping about 20-30° south;

(b) a dominant set, oriented north-northeast, dipping nearly vertical; and

(c) parallel to sheer zones, oriented east-northeast.

The north-northeast joint orientation is also that generally followed by felsic dikes in the Boston Basin (striking N15-45°E, dipping 60-90°) and the Stony Brook Fault.

3.3 Quaternary Geology

Based on drilling (Figures 5 and 6) and a seismic refraction survey, approximately 45 to 120 feet of Quaternary sediments have been deposited over the Cambridge Argillite bedrock at the AMTL. While the precise stratigraphy varies from hole to hole, a generalized ascending sequence consists of a basal till of fairly cohesive, silt rich gravel; a moderate to well sorted olive brown, silty, fine-grained sand; a medium to coarse-grained brown sand, locally grading to about 30% gravel; locally a sandy peat; and finally, fill material or disturbed sand and gravel.

3.3.1 Basal Till

The basal till was encountered in only two holes on site, C01 and C03 and penetrated only in C01. In C01, the till was only six feet thick and consisted of round to subround cobbles of granite and felsic volcanics and subangular fragments of argillite. No split spoon samples were obtained in the till in C01 because of refusal, so the composition of the matrix is not known. In C03, the till consisted of a gray green silt rich gravel with angular decomposed rock fragments and medium to coarse-grained sand. While the exact thickness of the till is not known at the location of C03, based on the depth of bedrock estimated from the seismic refraction profile, it would appear to be approximately 25 feet thick. In drilling previously completed to gather geotechnical data for foundation design, the till was encountered in a hole approximately 200 feet west of M03 at a depth of 76 feet. The till was described as a dense brown clayey silty sand with gravel.

3.3.2 Silty Sand

The silty sand is found across the site and is usually comprised of a moderate to well sorted, very fine to fine-grained sand, with a silty-clayey matrix, commonly laminated. Its thickness ranges from approximately 10 feet in C03 to 50 feet in C01. It does not appear to be encountered in M07 or M08 and is thinnest in C03, so it

may pinch out eastward. Since it was penetrated only in these two holes, it is not possible to make any conclusions regarding systemic variations in thickness. The silty sand probably represents a distal outwash deposit in a lacustrine environment.

3.3.3 Medium to Coarse Sand/Gravel

The medium to coarse-grained sand/gravel unit is highly variable in textural composition and is not found over the entire site. Where encountered, it lays above the silty sand and is overlain by fill and disturbed sands and gravels. It was not encountered in the northwest corner of the facility (Figure 5) and seems to grade from a medium to coarse-grain, well sorted, brown sand in the west portion of the facility to a yellowish brown, poorly sorted, gravel (30-40% pebbles and cobbles) with a poorly sorted, fine to coarse-grained sand matrix to the east. It ranges in thickness from absent to more than 35 feet, but averages approximately 10 feet. It is sometimes difficult to distinguish the gravel from disturbed or fill material, but in most cases the fill gravels were grayish brown and contained exotic debris such as brick, slag, concrete, and ceramics. The sand/gravel deposits probably represent fluvial (glacial meltwater) deposits.

3.3.4 Peat

In C03 at the southeast corner of the facility (Figure 6), a sequence of organic rich sand and sandy peat was encountered. This is the lowest portion of the AMTL (11.9 feet), about 9 to 10 feet above normal Charles River elevation. The sandy peat probably represents a flood plain wetland deposit and consisted of grayish brown woody plant fragments and silty fine sand. When exposed to air, the peat gave off a sulfurous odor and immediately oxidized to a black brown color. Peat was not encountered in M11 or M06, the other low elevation hole locations. Examination of the cross section of Figure 5 suggests that any peat that may have been deposited at that stratigraphic elevation would have been eroded by the deposition of the coarse sandy gravels which may represent a flood deposit.

3.3.5 Fill and Surficial Soils

Fill at the AMTL facility is variable in distribution and thickness but is generally less than 20 feet. Usually the fill consists of poorly sorted sandy gravel, grayish brown in color. It commonly contains exotic debris such as brick, slag, concrete, and ceramics which can be used to distinguish it from the underlying fluvial gravels.

The surficial soil at the AMTL is classified as Merrimac gravelly sand loam. It consists of 6 to 10 inches of dark brown gravelly sandy loam overlying 15 to 25 inches of yellow brown, friable gravelly sandy loam. The soil has been repeatedly disturbed during the history of the AMTL by various construction activities.

Depth from surface to bedrock was estimated across the site using three seismic refraction profiles (Figure 7). The results of these three profiles, shown in Figure 8, indicate a generally, gently undulating surface. The east-west profile shows a bedrock surface varying from 47 feet (below surface) at the northwest corner of the facility, falling off to about 110 feet and then rising to 90 feet at the northeast corner. The north-south profiles show a decrease in depth from 120 feet at the north to about 65 feet at the south. Based on the east-west seismic refraction profile bedrock at location C01 was predicted at 57 feet. The actual depth was 61.5 feet indicating very good agreement. The two profiles at the southeast corner of the facility which show a bedrock surface rising toward the Charles River, show no evidence of the Charles Buried Valley which is reputed to border the south margin of the facility (Figure 9).

3.4 Hydrology

3.4.1 Surface Water

Surface water run-off and natural drainage at the AMTL has been greatly influenced by modifications made to the natural land surface by construction of various structures and paved areas such as roads and parking lots. Watertown, in the vicinity of the AMTL, is heavily developed. The nearest pond, Sawins Pond, is approximately 3,000 feet east of the AMTL. The Charles River, one of the primary drainages in the Metropolitan Boston area, borders the site to the south. There are no known streams or other natural drainages to the Charles River in the vicinity of the AMTL. Current surface drainage is dominantly to the storm sewer system which discharges into the river. Some natural run-off will follow topography toward the river. Natural recharge through seepage is probably quite minimal in the vicinity of the AMTL because of the number of structures and paved areas.

3.4.2 Groundwater

Characterization of groundwater hydraulics at the AMTL is based on 17 borings and 16 monitor wells installed at the site during May and June of 1988. Water level measurements were taken and in situ permeabilities measured by falling and rising head tests.

Based on water level measurements taken at all wells and the Charles River on July 13, 1988 (Table 2), groundwater contours were estimated (Figure 10). These contours indicate flow is generally to the south, toward the River. In the northeast corner of the site, flow is to the southeast initially and then swings around to the south. Using the contours shown in Figure 10, gradients were estimated. Across the west portion of the site, the gradient was 0.025 (south). At the north central portion of the site, the gradient was 0.03 (southeast) but to the south decreases to 0.003. At the east margin of the site, the gradient was 0.003 (south).

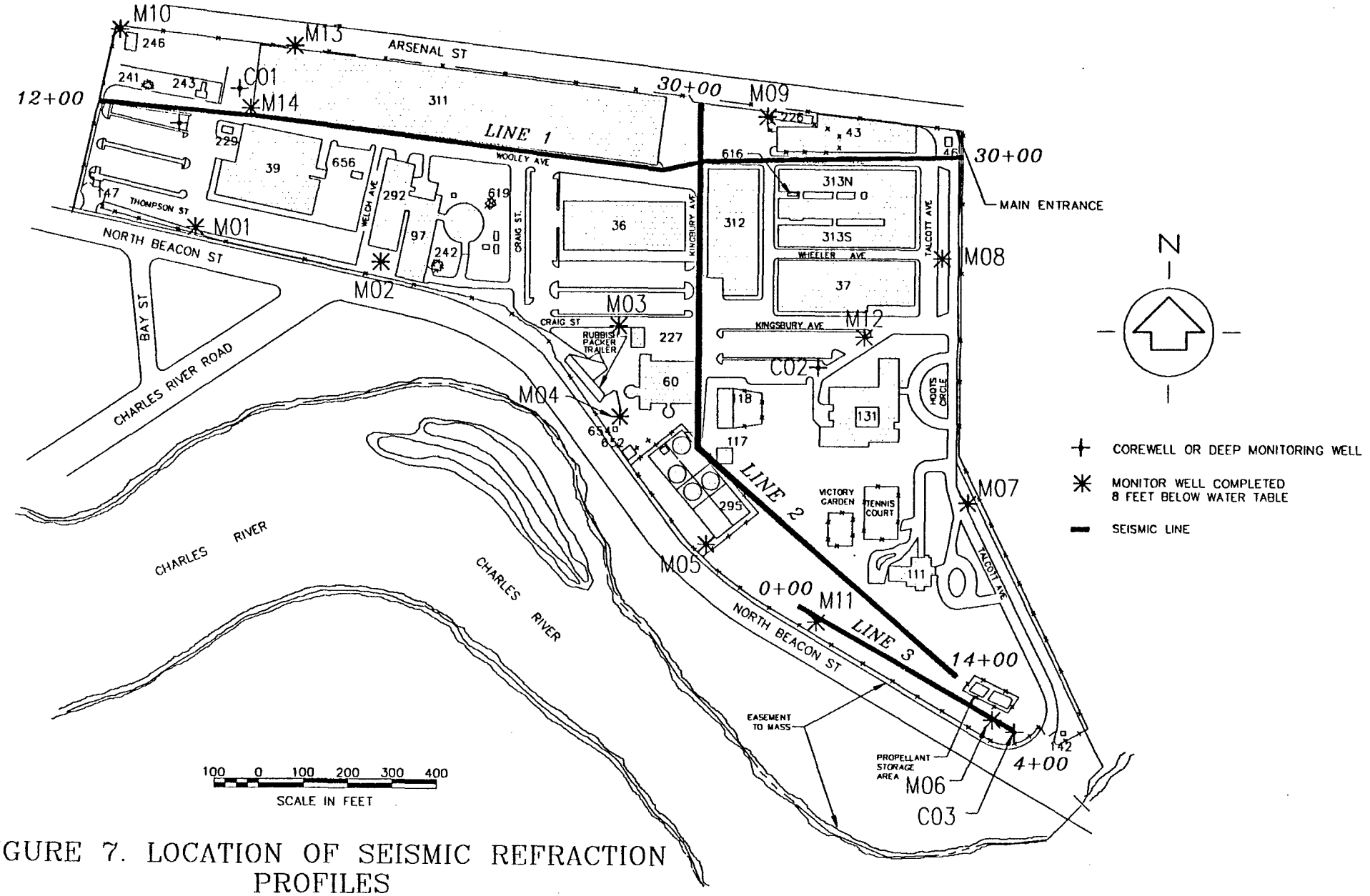
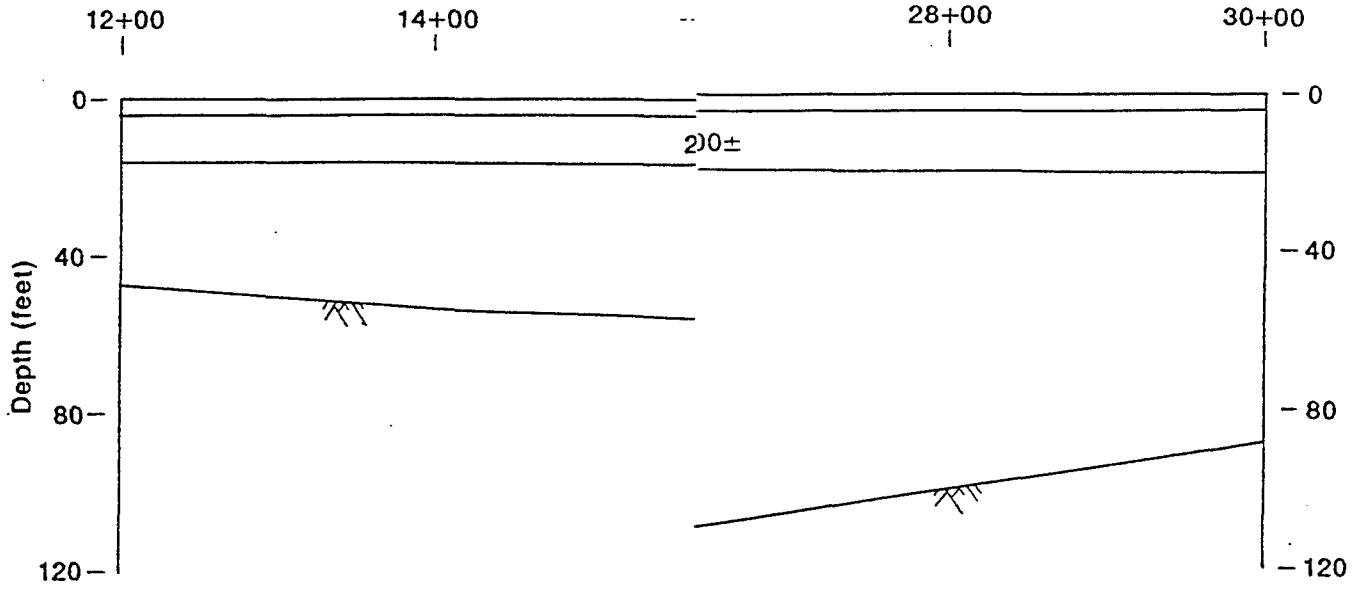
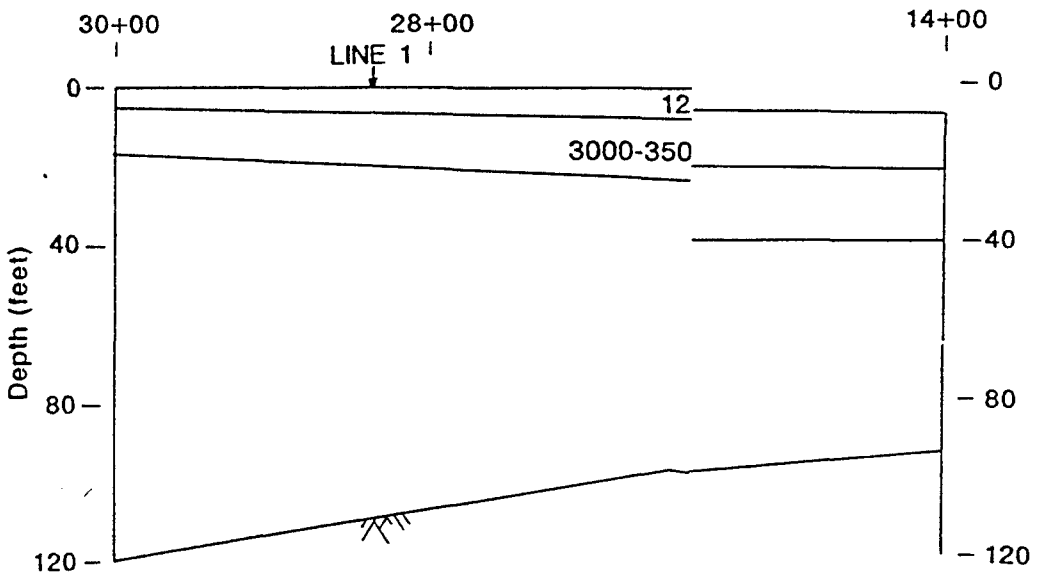
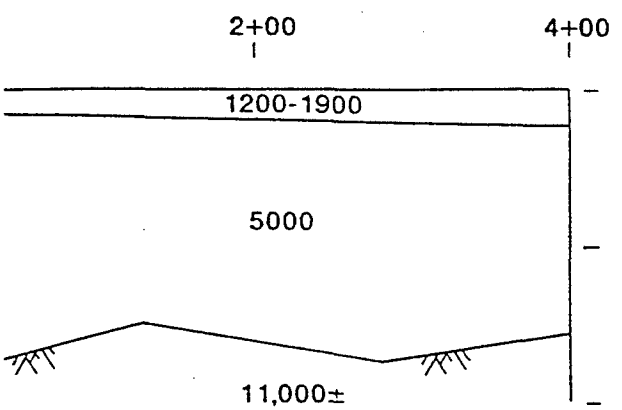


FIGURE 7. LOCATION OF SEISMIC REFRACTION PROFILES





LINE 3



PHYSICAL TIONS S LABORATORY CHUSETTS NC.	SEISMIC REFRACTION PROFILES Figure 8.

Arthur D. Little, Inc.

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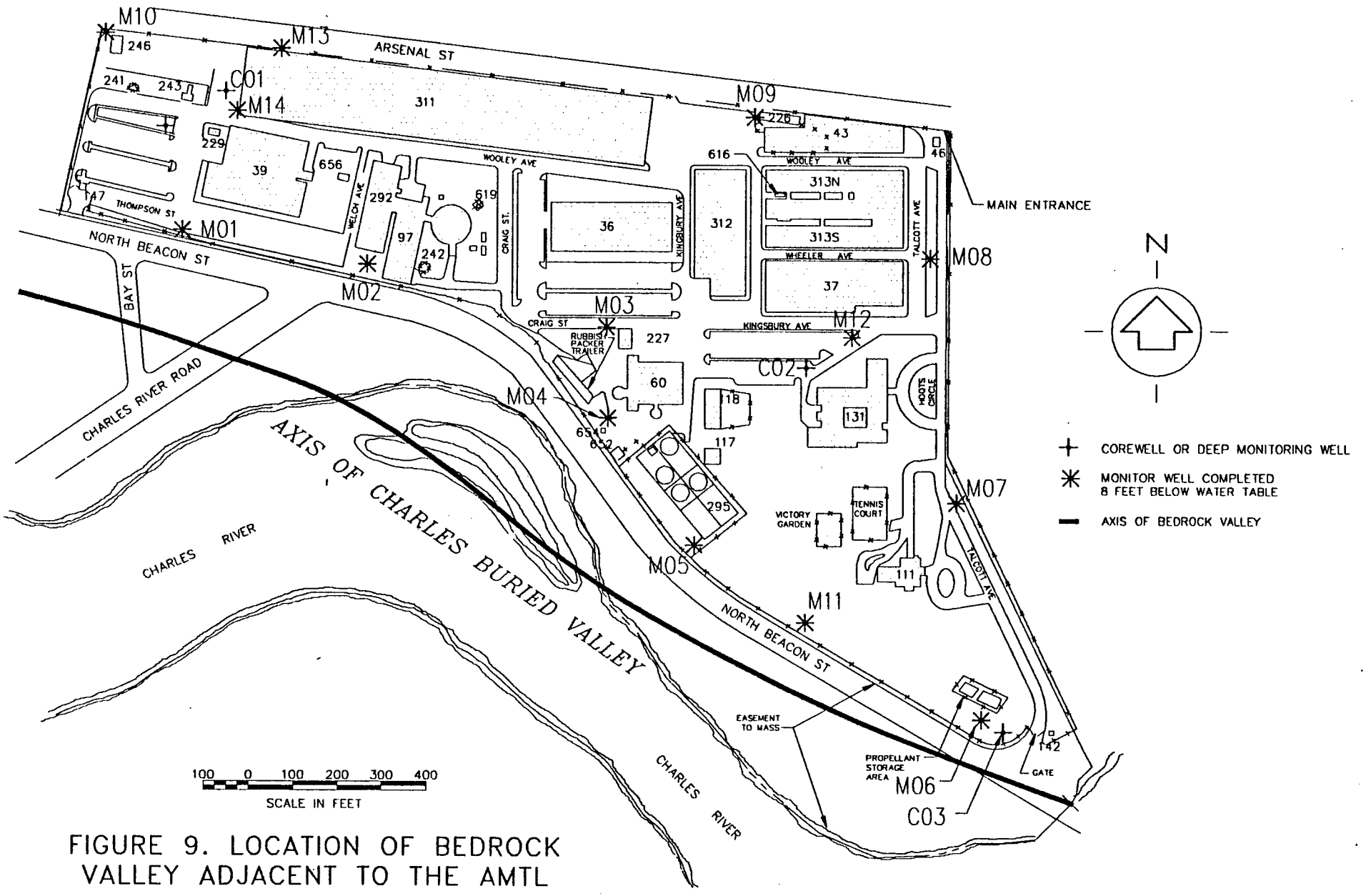


FIGURE 9. LOCATION OF BEDROCK VALLEY ADJACENT TO THE AMTL

Source: USATHAMA, 1980

TABLE 2. GROUNDWATER SURFACE ELEVATIONS ON JULY 13, 1988

Monitor Well	Elevation of Well* (Feet, M.S.L.)	Water Depth** (Feet)	Water Elevation (Feet, M.S.L.)
CO2	37.49	31.63	5.86
CO3	11.90	8.45	3.45
MO1	24.98	7.56	17.42
MO2	24.04	10.49	13.55
MO3	36.63	23.75	12.88
MO4	36.52	29.19	7.33
MO5	15.93	10.82	5.11
MO6	11.96	8.15	3.81
MO7	34.84	29.67	5.17
MO8	34.48	33.70	5.78
MO9	37.03	16.77	20.26
MO10	32.86	11.00	21.86
MO11	11.01	6.17	4.84
MO12	38.52	32.14	6.38
MO13	35.30	13.19	22.11
MO14	35.49	17.19	18.30

*Elevation of well is ground surface because of flush mount.
**Depth below ground surface.

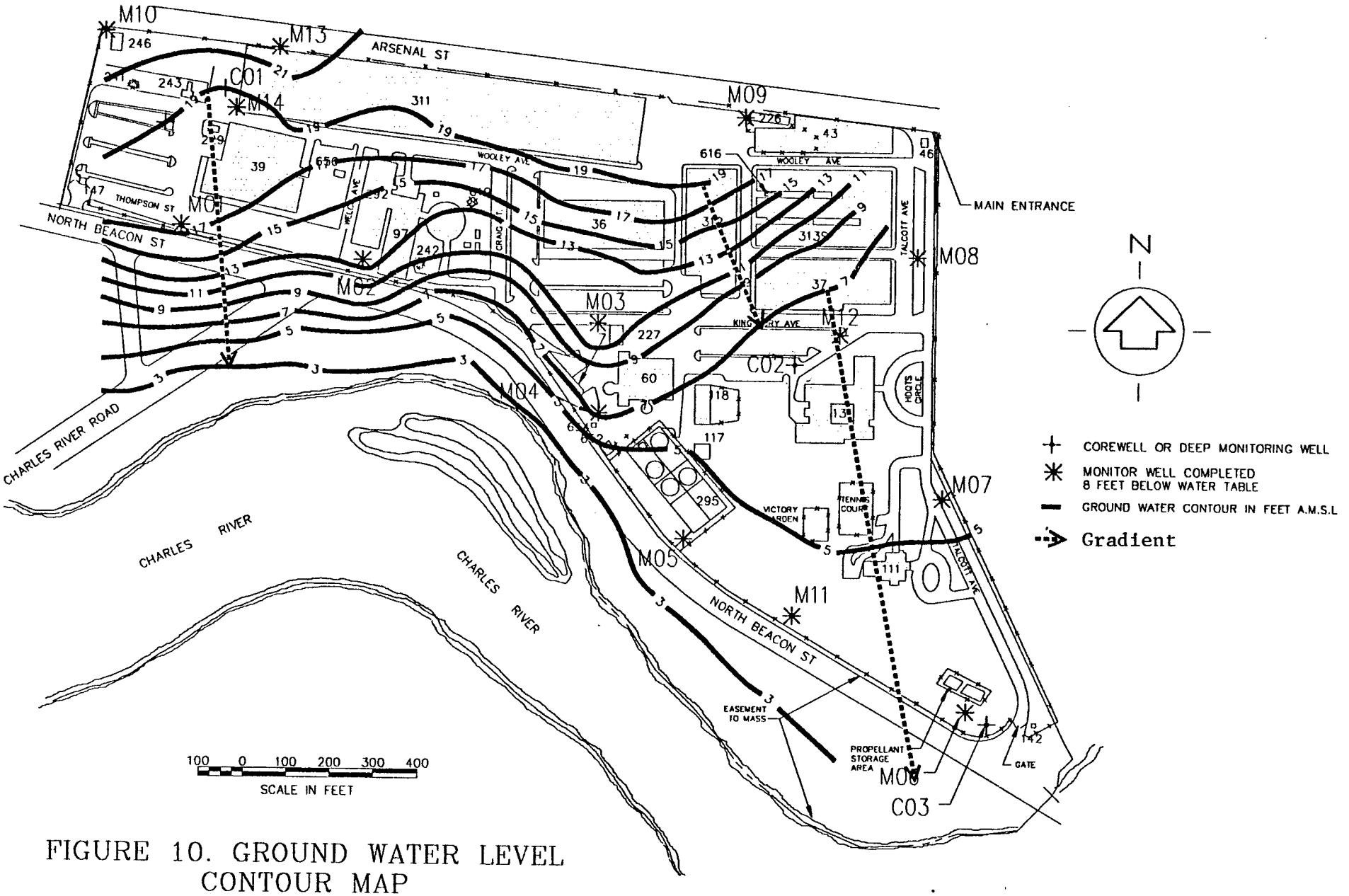


FIGURE 10. GROUND WATER LEVEL CONTOUR MAP

TABLE 3. CALCULATED IN SITU HYDRAULIC CONDUCTIVITY MEASUREMENTS

Well No.	Lithology	Hydraulic Conducitivity (cm/sec) Rising Head	Falling Head	Laboratory
C01	Silty sand	-	-	2.2×10^{-6}
C02	Silty sand	9.53×10^{-3}	3.35×10^{-2}	-
C03	Silty sand	9.53×10^{-3}	9.18×10^{-3}	1.0×10^{-7}
M01	Medium-coarse sand	1.20×10^{-2}	2.75×10^{-2}	2.5×10^{-7}
M02	Fine-coarse sand	2.82×10^{-2}	3.53×10^{-3}	1.5×10^{-6}
M03	Silty sand	4.24×10^{-2}	*	-
M04	Fine-coarse sand	2.47×10^{-2}	*	-
M05	Silty sand	1.34×10^{-2}	*	-
M06	Silty sand	1.06×10^{-2}	1.06×10^{-3}	-
M07	Fine-coarse sand	6.35×10^{-2}	*	-
M08	Medium sand	3.32×10^{-2}	1.66×10^{-2}	-
M09	Silty sand	4.24×10^{-3}	3.04×10^{-2}	-
M10	Medium sand	4.24×10^{-3}	6.71×10^{-3}	-
M11	Silty sand	7.06×10^{-4}	1.41×10^{-3}	-
M12	Fine-medium sand	3.00×10^{-2}	6.00×10^{-2}	-
M13	Fine-coarse sand	2.29×10^{-2}	3.07×10^{-2}	-
M14	Silty Sand	1.09×10^{-2}	*	6.0×10^{-7}

* Indicates erratic or insufficient data or insufficient displacement of water level.
- Indicates laboratory tests could not be run.

4.0 METHODOLOGY

4.1 Geotechnical Approach

As a preliminary step in conducting a remedial investigation and feasibility study, EG&G Idaho, Inc., completed a preliminary assessment/site inspection (PA/SI) at the facility (EG&G, 1988). The PA/SI consisted of (1) reviewing historical records and conducting interviews to determine past practices and their potential impact on the environment, (2) wipe sampling of building interiors for radionuclide monitoring, and (3) a shallow soil gas survey to identify areas of potential volatile organic contamination.

The PA/SI review of historical records and interviews revealed that because of past practices, the following contaminants might be present in soil or groundwater:

(a) depleted uranium (DU);
(b) chlorinated solvents;
(c) a wide variety of toxic organic compounds used as reagents in organic synthesis and fiber epoxy composite manufacturing;
(d) a wide variety of toxic inorganics such as lead, beryllium, cadmium, mercury, nickel, chromium, and cyanide; and
(e) hydrocarbons including fuels, cutting, quenching, and heat transfer oils.

The shallow soil gas survey was conducted by Tracer Research Corporation (EG&G, 1988). Samples of soil gas were taken at depths of 1 to 20 feet with most samples in the range of 3 to 5 feet. The samples were analyzed in the field on a gas chromatograph with an electron capture detector for chloroform, 1,1,1-trichloroethane (TCA), carbon tetrachloride, trichloroethylene (TCE), and perchloroethylene (PCE), and on a gas chromatograph with a flame ionization detector for benzene, toluene, and xylene.

The soil gas survey revealed coincident TCA and benzene contamination along the edge of the AMTL at the northwest corner of Building 311. The highest concentrations were 425 mg/l TCA and 24 mg/l benzene in the vicinity of M13. Other areas of low level benzene contamination <1 mg/l are found in the center of the facility near M03 and along the southeast margin between M11 and M06.

Based on the information obtained in the PA/SI, monitor well and core hole locations were selected by EG&G. The locations selected are shown in Figure 4, and the rationale for selecting each location is summarized in Table 4.

TABLE 4. SELECTION CRITERIA FOR MONITOR WELL LOCATIONS (EG&G IDAHO, INC.)

Well No.	Rationale
M01	Downgradient perimeter
M02	Downgradient perimeter, downgradient of analytical chemistry lab (292)
M03	Low concentration benzene contamination
M04	Possible fill area, cinder and ash from coal fired plant
M05	Downgradient of bulk fuel oil tanks documented spills
M06	Downgradient perimeter
M07	Eastern perimeter
M08	Eastern perimeter
M09	Upgradient perimeter, underground fuel tanks, DU facility
M10	Upgradient perimeter
M13	Upgradient perimeter, coincident TCA and benzene contamination
M14	Downgradient of waste storage area
C01 C02 C03	Core holes situated to develop information on depth to and nature of bedrock across site

4.2 Drilling Techniques

Sixteen holes were augered in overburden and one hole cored into bedrock and abandoned. All drilling and well construction was performed by GZA Drilling, Inc., of Brockton, Massachusetts. Holes were drilled with a CME 75 or CME 55 drill rig using an 8¼" hollow stem auger to a completion depth of approximately 10 feet below the water table. Soil samples for logging purposes were obtained every 5 feet using a 2 inch I.D. split spoon. Soil samples for chemical analysis and physical testing were taken at specified depths.

The hole cored into bedrock, C01, was drilled by advancing 10 inch I.D. hollow stem augers to the water table, spinning 8 inch casing to refusal (top of basal till), and coring through the till, casing with 4 inch casing and coring 15 feet into bedrock using diamond surface set bit with a 3 inch core barrel. Water was used during coring and recirculated from a settling tank. Because of the low hydraulic conductivity measured for the bedrock during a pressure packer test, it was decided by EG&G Idaho, Inc., upon Arthur D. Little's advice, not to install a monitor well and C01 was abandoned. All casing was removed and the hole was grouted to surface using cement.

The drill rigs and all equipment were steam cleaned at GZA Drilling's Brockton shop prior to arrival on site, upon arrival at the site, after completion of each hole, and prior to leaving the site. A steam cleaning area adjacent to the hydrant used as a water source was set up using heavy mil plastic, forming a lip to contain the water. Water was pumped into 55 gallon drums and labeled "steam cleaning water" for later disposal.

4.3 Borehole Logging

Boreholes were logged by geologists from Weston Geophysical Corporation under the supervision of Arthur D. Little, Inc. Required information was noted in ink on the boring logs and included depth, sample intervals, recovery, blows per 6 inch in advance of the split spoon, and a geologic description of cuttings and split spoon samples. Soils were described as to color using the Geological Society of America Rock Color Chart (Munsell System). Textural classification was performed according to the Unified Soil Classification System. Boring logs are found in Appendix A.

The rock core from C01 was logged by Weston and Arthur D. Little geologists, photographed, and placed in wooden core boxes to be stored at the AMTL.

4.4 Sampling

Soil sampling for geological logging, chemical analysis (Table 5), and physical testing (Table 6) was done by Weston geologists supervised by Arthur D. Little personnel. Water sampling of the monitor wells was done by Arthur D. Little personnel. Details of the sampling and

TABLE 5. LOCATIONS AND DEPTHS OF SOIL SAMPLES TAKEN FOR CHEMICAL ANALYSIS*

Hole No.	Depth (Ft)	VOAS	Complete**	Metals	Radiological
C01	12-14	x	x	x	x
C02	6-8	x	x	x	x
	24-26	***			
	26-28	***			
C03	7-9	x	x	x	
M01	11-13	x		x	
M02	2-4	x		x	
M03	14-16	x	x	x	x
	19-21	x	x	x	
M04	4-6	x		x	
M05	6-10	x	x	x	x
M06	4-6	x		x	
M07	4-6	x		x	
M08	2-4	x		x	
M09	8-10	x		x	
M10	2-4	x		x	
M11	6-8	x		x	
M12	4-6	x		x	
M13	8-10	x		x	
M14	6-8	x		x	

*Samples collected by Arthur D. Little, Inc., and sent to Metatrace for chemical analysis.
**Complete analysis includes volatile organics, semi-volatile organics, pesticide, PCB, metals, cyanide, sulfide, and USATHAMA compound list.
***Taken by and analyzed at Arthur D. Little, Inc., for evaluation of health hazards.

decontamination methodologies are presented in Arthur D. Little's Sampling Plan. (Arthur D. Little, 1988)

4.4.1 Geological Soil Samples

Geological samples were taken every 5 feet, when possible, using a standard 2 inch O.D. split spoon. A standard 140 pound weight was dropped 30 inches to advance the split spoon. Split spoons were decontaminated between use by brushing and rinsing with tap water. Samples were logged and placed in 2 inch diameter, clear glass jars, and stored at the AMTL. All geological samples and drill cuttings were monitored using an HNU PI-101 meter for volatile organic compounds and for radiation using a pancake Geiger-Muller probe and a NaI gamma detector.

4.4.2 Soil Samples for Chemical Analysis

Soil samples were taken for chemical analysis at predetermined depths in each hole for a set of predetermined analytes (Table 5). Samples were taken using standard 2 and 4 inch O.D. stainless steel split spoons. Samples were placed in jars and vials supplied by Metatrace, (the analytical services contractor), labeled, sealed, and stored in ice in insulated coolers. Decontamination of the split spoon and associated sampling equipment consisted of:

(a) non-phosphate detergent wash;
(b) triple rinse with tap water;
(c) rinse with pesticide-grade hexane;
(d) rinse with deionized, distilled water;
(e) wrap in aluminum foil.

As with the geological soil samples, the soil samples taken for chemical analysis were screened for volatile organic compounds using an HNU PI-101 meter and for radiation using a Geiger-Muller pancake probe and a NaI gamma detector.

A chain-of-custody form was completed and the samples shipped by Federal Express to Metatrace, Earth City, Missouri for analysis.

4.4.3 Soil Samples for Physical Analysis

Soil samples were taken for physical analysis at the intervals shown in Table 6. Samples were taken using a 2.875 inch I.D. Shelby tube in compressible soils and a 2 inch O.D. standard split spoon in incompressible soils. Shelby tube samples were sealed in the tube with paraffin. Samples taken with a split spoon were placed in 2 inch diameter clear glass bottles. Physical analyses were performed at Goldberg Zoino Associates, Inc., Newton, Massachusetts soil laboratory.

TABLE 6. LOCATIONS AND DEPTHS OF SOIL SAMPLES TAKEN FOR PHYSICAL ANALYSIS

Hole No.	Depth (Ft)	Atterberg Limits	Bulk Density	Specific Gravity	Porosity	Hydraulic Conductivity	Sieve Size
CO1	24-27 S	x	x	x		x	x
	47-50S	x		x			x
CO2	none						
CO3	11-13 S	x	x	x		x	x
	29-31			x			x
M01	11-13 S/L	x	x	x	x	x	x
M02	16-18S	x	x	x	x	x	x
M03	4-6			x			x
M04	14-16			x			x
M05	14-16	x		x			x
M06	15-16	x		x			x
M07	0-2	x		x			x
M08	4-6	x		x			x
M09	21-23						
M10	17-19	x		x			x
M11	2-4	x		x			x
M12	12-14	non-plastic		x			x
M13	19-21	x		x			x
M14	16-18S	x	x	x	x	x	x

4.4.4 Water Samples for Chemical Analysis

Water samples were taken from each monitor well for chemical analysis. Prior to sampling the well, the air space was monitored for volatile organic compounds using an HNU PI-101 meter. A water level measurement was made using a Solinst (Model 101) electrical conductivity water level meter. To purge the well, five well volumes of water were removed using a Robin EY25W submersible or Meyer pump. Before each well volume of water was removed, pH, conductivity, and temperature were measured. Purge water was placed in 55 gallon drums and labeled for later disposal. Water samples were taken using a Teflon bailer and placed in bottles supplied by Metratace, preserved as necessary, sealed, labeled and stored in ice. Samples of water submitted for dissolved metal analysis were filtered using a 0.45 micron Sample-Pro FF8100 filter and preserved with HNO_3. A chain-of-custody form was completed and the samples shipped to Metatrace, Earth City, Missouri for analysis. Copies of these forms are found in Appendix I.

Teflon bailers were decontaminated between wells by the following procedure:

(a) non-phosphatic detergent wash;
(b) triple rinse with tap water;
(c) 10% HNO_3 rinse;
(d) triple rinse with tap water;
(e) double rinse with pesticide-grade hexane;
(f) rinse with deionized, distilled water;
(g) wrap in aluminum foil.

Calibration techniques and frequencies for the pH-conductivity meter and thermometer are detailed in the Arthur D. Little, Inc., Sampling Plan.

4.5 Well Installation

Sixteen of 17 borings at AMTL were completed as monitor wells by GZA Drilling, Inc., under the supervision of Weston Geophysical Corporation and Arthur D. Little, Inc.

4.5.1 Technique

Wells were constructed of casings and screens consisting of 4 inch, flush-threaded schedule 40 Polyvinyl Chloride (PVC) pipe. The screened interval was constructed using 10 foot, 0.10 inch slotted PVC screen extending from 2 feet above to 8 feet below the water table, as observed at the time the hole was drilled.

The granular filter pack extended no more than 5 feet above the top of the screen. Five feet of bentonite pellets were placed above the granular pack. The remainder of the annular space was filled with bentonite grout to within 5 feet of ground surface. After the bentonite grout settled, the hole was sealed from surface to approximately 5 feet with concrete. The concrete had the following specifications:

(a) maximum aggregate size of 3/4 inches;
(b) comprehensive strength of 3000 psi at 28 days; and
(c) six inch maximum slump.

Prior to installation, all well materials (casings, screen caps) were steam cleaned. All casing joints were threaded and no solvent, glues or thermal welding procedures were used to join well casing materials.

Wells were completed by cutting the 4 inch PVC casing off approximately 6 to 12 inches below grade, installing a 4 foot long, 6 5/8 inch diameter steel protective casing with locking cap over the PVC casing (about 3 inches below grade) and finishing with a 13 5/8 inch diameter gasketed manhole (1 inch above grade) set in cement (Figure 11). Sand was placed above the grout, below the concrete to drain any water that might enter the annular space between the PVC well casing and the steel protective casing.

Some wells (M01, M02, M05, M06, M10, M11, M13, and M14) were sufficiently shallow that the grouted interval was omitted. The surficial cement seal rests directly on the bentonite pellet seal in these wells. Details of individual well construction are documented on the well construction forms in Appendix B.

4.5.2 Materials

PVC Casing and Screen. Casing and screen used consisted of 4 inch flush threaded schedule 40 polyvinyl chloride (PVC) pipe conforming to the National Sanitation Foundation Standard 14 bearing a rating logo for potable water use. The screen was machine slotted 0.010 inch. All casing and screen were steam cleaned by the manufacturer and wrapped in plastic. The casing and screen were supplied by Diedrich Drilling Equipment, Inc., of LaPorte, Indiana.

Granular Filter Pack. The granular filter pack consists of silica sand (Mystic White Pool Filter Sand) supplied by U.S. Silica Company, Ledyard, Connecticut. The size distribution is shown in Figure 12.

Bentonite. Bentonite (Quik-Gel) supplied by NL Baroid/NL Industries was used in the grout formulation. It consists of finely ground sodium bentonite. Bentonite pellets (Bentonite PI Pellets 3/8 inch) supplied by Piezometer Research and Development, Bridgeport, Connecticut, were used as a seal above the sand pack.

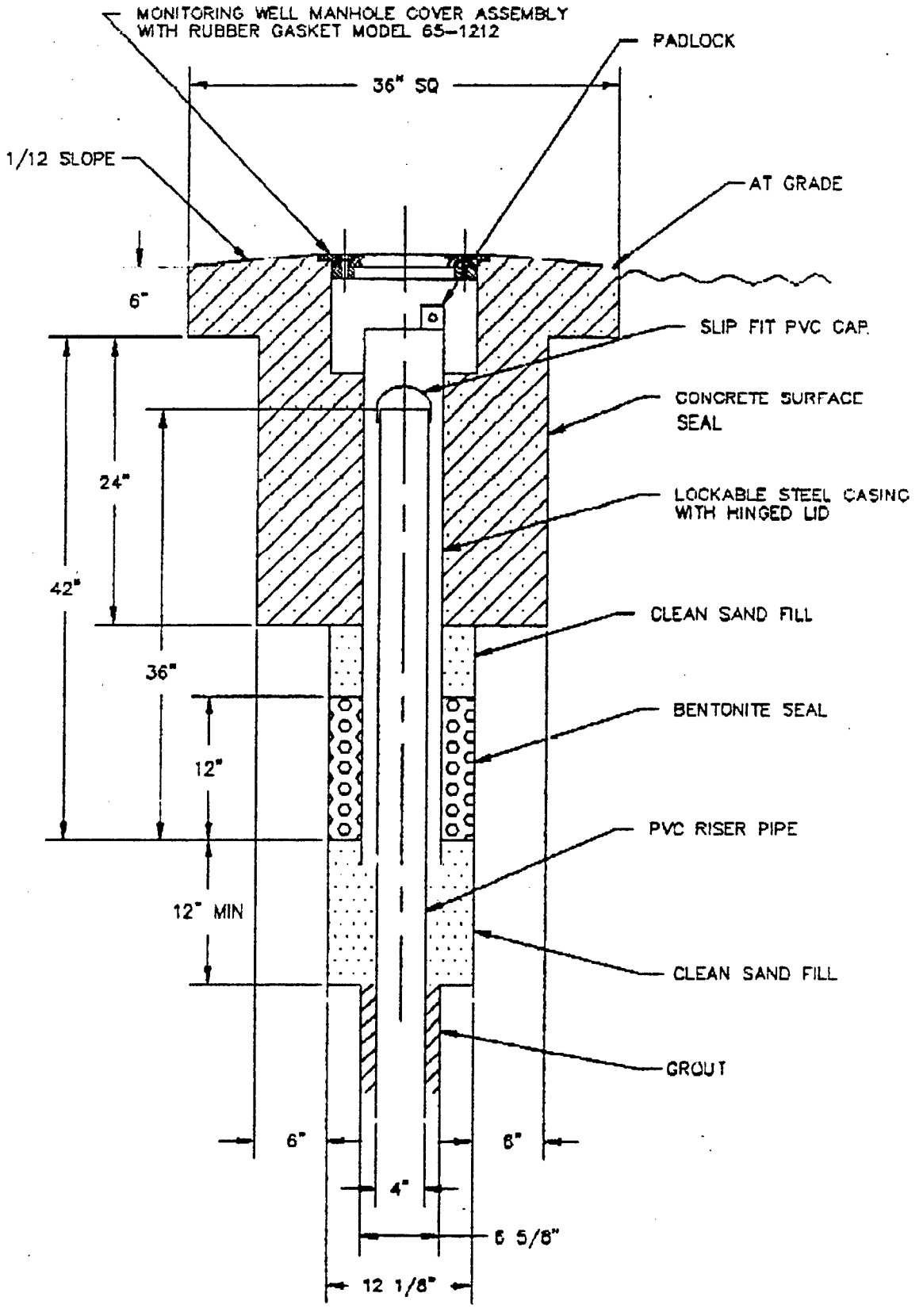


FIGURE 11. WELL COMPLETION (MANHOLE-TYPE)

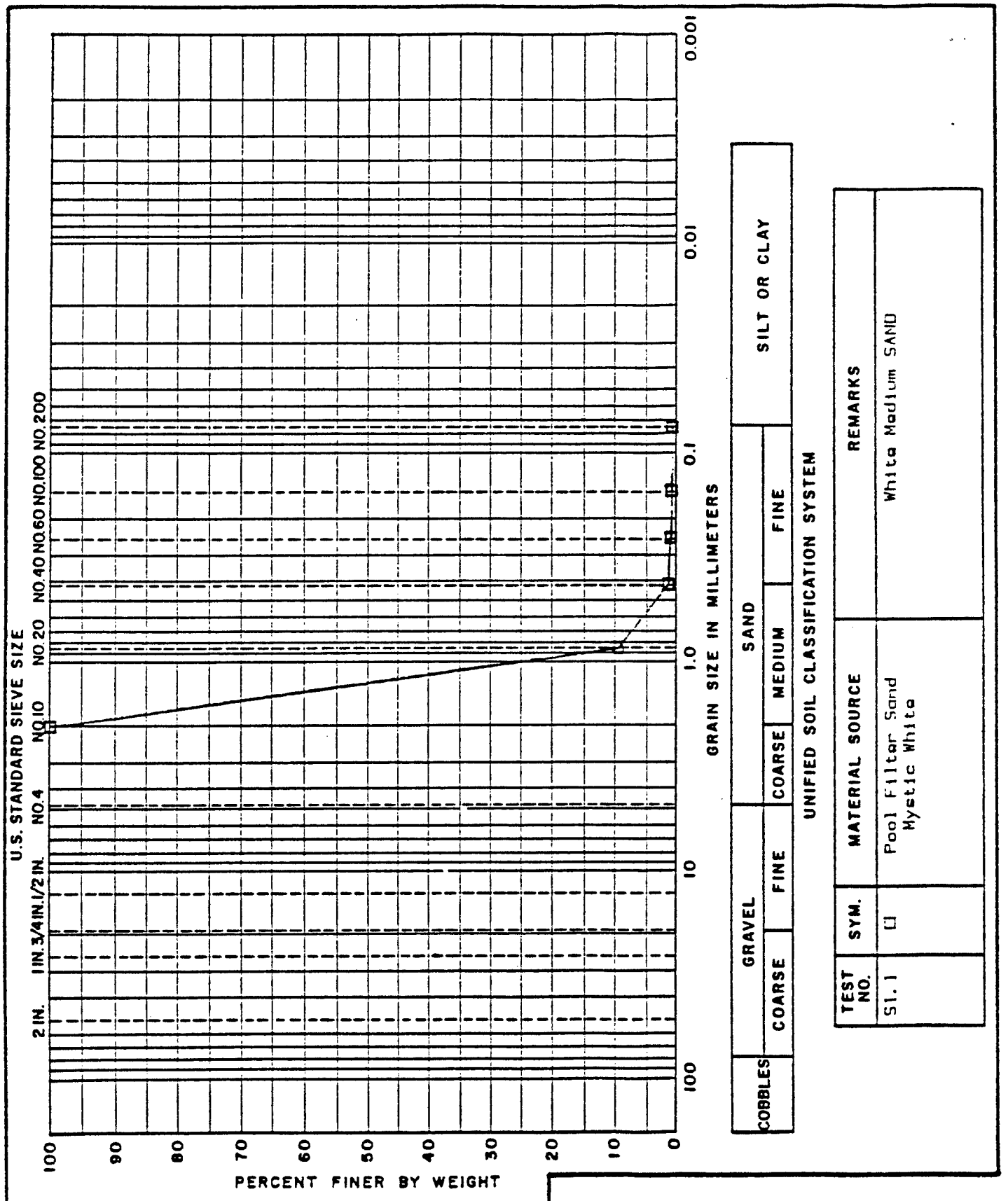


FIGURE 12. SIZE DISTRIBUTION FOR SAND PACK

Bentonite Grout. Grout used in well construction consisted of 20 parts Portland cement (Type II or V), 1 part bentonite, and a maximum of 8 gallons of water per 94 pound bag of cement. Grout was placed in the annular space above the bentonite seal to within 5 feet of the ground surface by tremie pipe method.

Drilling Water. Water used during the drilling program was obtained from a fire hydrant at the AMTL. Water is supplied to the hydrant by the Massachusetts Water Resources Authority from the Norumbega, Weston, and Spot Pond Reservoirs. The water was sampled and analyzed for sulphate, chloride, metals, volatiles, and semivolatiles.

4.6 Well Development

All wells were developed no sooner than 48 hours after well construction but prior to seven days. The wells were developed by removing at least five well volumes based on the volume of water in the well casing and screen and the saturated well annulus assuming 30 percent porosity. In some situations, as M13, more than five volumes were removed to obtain clear water. Conductivity and pH were also monitored prior to, during and after development to document stabilization of these parameters. Pumping was done using a 4 inch Robin EY25W submersible pump or a Meyer surface pump with plastic hose. Development water was placed in 55 gallon drums, labeled, and stored for disposal. Well development was done by personnel from GZA Drilling, Inc., Weston Geophysical Corporation, Arthur D. Little, Inc., and EG&G Idaho, Inc. Details of well development for each well are documented on forms found in Appendix C.

4.7 Geophysical Surveying

Three geophysical surveys were conducted at the AMTL:

(a) a ground penetrating radar survey to locate buried utilities at potential monitor well sites;

(b) a refraction seismic survey to map depth to bedrock and provide information on stratigraphic correlation; and

(c) a borehole geophysical survey in C01 and C03 to provide information on stratigraphic correlation.

The ground penetrating radar and seismic refraction surveys were performed by Weston Geophysical Corporation and the borehole geophysical surveys by Appalachian Coal Surveys, Pittsburgh, Pennsylvania, under the supervision of Weston Geophysical Corporation.

4.7.1 Ground Penetrating Radar Survey

A ground penetrating radar survey of the initially proposed monitor well and borehole locations at the AMTL was conducted to identify and locate buried utilities present, such as electrical conduits,

telephone conduits, and piping. It was not intended to provide any geological information. Ground penetrating radar is an electromagnetic survey technique that reveals a graphic cross-sectional view of layered material below the ground surface. It is an echo-ranging technique similar to the single-trace reflection method commonly used in marine bottom profiling in which reflective layers are traced by echo patterns generated in response to acoustic impulses. The two techniques differ in that the acoustic method uses audio frequency sound waves transmitted through a water medium to the material under investigation. The radar method transmits, directly to the surface, impulses of radio waves at frequencies up to a 1000 megahertz.

In a radar system, high-frequency impulses of radio energy are generated by the transmitter. A beam of these impulses is emitted by a special antenna placed in close proximity to the ground so that it couples electromagnetically to the surface material. Each impulse propagates downward through the ground surface and into the material below. At interfaces, part of the signal is reflected while part is transmitted still deeper to be reflected by other layers or isolated bodies. For each impulse transmitted, a string of reflected impulses is returned to the antenna in a time sequence proportional to the round-trip travel time to each reflector. After transmitting the outgoing pulse, the system instantly switches from the transmitter to the receiver in order to detect the echo signals. When operated in the field during data acquisition, a graphic recorder provides an immediate view of the data.

Ground penetrating radar surveys are carried out by pulling the antenna slowly along a pre-measured survey line. Radar impulses are transmitted synchronous with a swept-stylus type graphic recorder. The recorder stylus sweeps across the paper at a uniform speed and echo signals cause the paper to be darkened at points proportional to the total travel time to the reflector producing the echo. The recorder detects the presence of an echo whenever the signal level exceeds a preset threshold. The pattern of darkened regions on the paper marks the reflective horizons in the earth. The distance shown on the recorder paper to any reflector is proportional to its depth below the path of the antenna.

Accurate determination of the depth to any layer requires calibration of the radar system. The depth to an identified reflector such as a pipe, a barrel or a geologic feature, is the most direct and easiest method available for vertical scale calibration.

Depth of penetration in a given material is limited by attenuation of the signal. Attenuation is a function of dielectric loss and of electrical conductivity loss which, in a given material, will vary with the amount of water, dissolved salt, temperature, density, and frequency of the radar impulses. Penetration of up to 75 feet has been reported for water saturated sands in Massachusetts glacial sediments. Wet clays, however, will attenuate the signal within five

feet. It is important to note that in a layered material a single, highly reflective layer alone can limit penetration by preventing the propagation of energy past it. In this case, apparent loss of energy is caused by reflection rather than by dissipation.

4.7.2 Seismic Refraction Survey

The seismic refraction survey method is a means of determining the depths to a refracting horizon and the thickness of major seismic discontinuities overlying the high-velocity refracting horizon. The seismic velocities measured by this technique can be used to calculate the mechanical properties of subsurface materials as well as for material identification and stratigraphic correlation. Interpretations are made from travel time curves showing the measurement of the time required for a compressional seismic wave to travel from the source (shot) point to each of a group of vibration sensitive devices (seismometers or geophones). The geophones are located at known intervals along the ground surface. Various seismic sources may be used, including a drop weight, an air gun, and small explosive charges.

Weston Geophysical Corp. used a seismic recording technique of continuous profiling and overlapping spreads. The seismic refraction equipment consisted of a Weston Geophysical trace amplifier, Model USA780, with a WesComp™ field computer system developed by Weston Geophysical and a recording oscillograph. In general, shots were located at each end and at the center of the seismic spread. A 1,000 pound drop hammer was used as a seismic energy source. Geophone spacings of 10 and 20 feet were used.

Continuous profiling was accomplished by having the end shot-point of one spread coincident with the end or intermediate position shot-point of the succeeding spread. The spread length used was determined by the required depth of penetration to the refracting horizon. It is generally possible to obtain adequate penetration when the depth to the refracting horizon is approximately one-third to one-quarter of the spread length.

The seismometer or geophone is in direct contact with the earth and converts the earth motion resulting from the shot energy into electric signals; a moving coil electromagnetic geophone is generally used. This type of detector consists of a magnet permanently attached to a spiked base which can be rigidly fixed to the earth's surface. Suspended within the magnet is a coil-wrapped mass. Relative motion between the magnet and coil produces an electric current with a voltage proportional to the particle velocity of the ground motion.

The electric current is carried by cable to the recording device which provides simultaneous monitoring of each of the individual geophones. The operator can amplify and filter the seismic signals to minimize background interference. For each shot the seismic signals detected by a series of geophones are recorded on either photographic paper or

magnetic tape, depending on job requirements. Included on each shot record is a "time break" representing the instant at which the shot was detonated.

The elastic wave measured in the seismic refraction method, the "P" or compressional wave, is the first arrival of energy from the source at the detector. This elastic wave travels from the energy source in a path causing adjacent solid particles to oscillate in the direction of wave propagation. At small distances between source and detector, the first arriving waves will be direct waves that travel near the ground surface through the lower velocity material. At greater distance, the first arrival at the detector will be a refracted wave that has taken an indirect path through the two layers. The refracted wave will arrive before the direct wave at a greater distance along the spread because the time gained in travel through the higher-speed material compensates for the longer path. Depth computations are based on the ratio of the layer velocities and the horizontal distance from the energy source to the point at which the refracted wave overtakes the direct wave.

Generally, the interpretation is by one or more of several methods such as ray-tracing, wave front methods, delay times, critical distances (W. M. Telford, et al., 1976). In addition, either a forward or inverse interpretation was performed using Weston's proprietary software. Since successful refraction interpretation is based on experience, all interpretation of refraction data were performed or thoroughly reviewed by a senior staff geophysicist.

4.7.3 Borehole Survey

Methods and Equipment

The boreholes at AMTL were logged by Appalachian Coal Surveys of Pittsburgh, Pennsylvania. Their equipment consisted of a truck mounted borehole logging system manufactured by Well Reconnaissance Inc., (now MLS, Inc.) of Fort Worth, Texas. All tools were less than 1-1/2 inches in diameter and enclosed in stainless steel housings. The logging cable used was 3/16 inch diameter, stainless steel, wire wrapped, four conductor and chemically stable. The following tests were run when possible:

(a) caliper
(b) natural gamma
(c) high resolution, short-spaced gamma-gamma density
(d) long-spaced gamma-gamma density
(e) neutron
(f) fluid conductivity
(g) spontaneous potential
(h) temperature
(i) wall resistivity

Resolution for each method is given in Table 7. Copies of the borehole logs are found in Appendix F.

The primary assumption made in borehole geophysical logging is that the measured properties are representative of the formation and that they are made in undisturbed material. This assumption is not always valid due to the fact that the radius of investigation (depth of penetration into the formation) of the tools may vary with the physical properties of the formation. However, good correlation was found between geophysical logs, sample logs, and well completion diagrams at the AMTL site.

Caliper

The caliper log uses a three-arm caliper to measure variations in hole diameter. It is only run in an uncased hole.

Natural Gamma

The natural gamma log uses a gamma ray detector to measure the gamma energies emitted by naturally occurring uranium, thorium and potassium (K^{40}). Generally, a gamma detector sensitive only to the narrow ban of energy (1.46 Mev for K^{40}) is used to distinguish potassium which is a common constituent of illitic-clay minerals, alkali feldspars, and micas. It is used to correlate shales and clay-rich sediments.

Gamma-Gamma Density

The gamma-gamma density logs measure in situ density using two sondes. The bottom sonde uses a concentrated source of monoenergetic gamma rays (Am 241 and Ra 226). The upper sonde, approximately 18 inches above the source uses a Geiger or scintillation detector. The source is shielded from the detector which only detects gamma rays which have travelled through the rock. Because of interaction with the rock, the detected level of gamma intensity is exponentially related to rock density. For a short source-detector separation, adjacent beds and bed thickness have little effect. However, the thickness and density of drilling muds or bentonite will affect the short-spaced log. Greater source-detector separation can be used to overcome mud and bentonite thicknesses.

Neutron

Neutron logs measure porosity by determining the amount of hydrogen, and therefore fluid, filling formational pore spaces. Neutrons emitted from an Am-Be source collide with hydrogen nuclei and are slowed to thermal energy. They may then be captured by other nuclei which emit capture gamma rays. Either capture gamma rays or thermal neutrons may be detected and measured. In large diameter holes with significant mud build-up (or annular bentonite in a well) the results may be less accurate.

TABLE 7. BOREHOLE GEOPHYSICAL LOGGING

Technique	Primary Area of Investigation	Vertical Resolution (ft)	Source
Caliper	B	Hole Diameter <.25 inch	Passive
Natural Gamma	F	1.5	Passive
Gamma-Gamma (High Resolution)	C	0.25	250 mCi Am241
Gamma-Gamma Density	F	1.0	250 mCi Am241
Neutron	F	1.5	3 Ci AmBe
Fluid Conductivity	B	N/A	Passive
Spontaneous Potential	F	0.5	Passive
Temperature	B	N/A	Passive
Wall Resistance	B	0.25	DC Voltage

F = Formation
B = Borehold
C = Well Construction

Source: Weston Geophysical Corporation

Fluid Conductivity

The fluid conductivity of a formation can be determined by measuring the conductivity of the pore fluid which contains dissolved salts which disassociate into cations and anions. The sonde uses a direct current voltage applied between two electrodes and measures the potential between two potential electrodes. The accuracy of the method decreases when the formations adjacent to the hole are infiltrated by drilling muds or bentonite.

Spontaneous Potential

The spontaneous or self-potential method measures the potential across a lithological contact. For instance, a clay or shale is permeable to Na^+ cations but not to Cl^- anions. Consequently, a potential develops at the boundary of a clay (shale) and sand as Na^+ cations pass into the shale and Cl^- anions increase in concentration in the sand. Instrumentation consists of a potentiometer connected to a downhole and surface electrode. It can only be used in uncased holes.

Temperature

Temperature of the well water is recorded using a thermocouple.

Wall Resistivity

Wall resistivity is measured using a sonde with electrodes that are in continuous contact with the wall. It provides some correlation with porosity since it is sensitive to the thickness of drilling muds and bentonite, which cannot infiltrate impermeable units. It can only be used in uncased holes.

4.8 Topographic Surveying

The surface elevation and coordinates of all monitor wells were determined by Design State Survey, Medford, Massachusetts. Coordinates were measured in the Massachusetts State Coordinate (Mainland) System to 1/100 of a foot. Elevations were measured relative to the National Geodetic Vertical Datum of 1929 to 1/100 of a foot. All data exceeds the contract specifications of horizontal control of ± 3 feet and vertical control of ± 0.05 feet. The survey instruments used were a Wild T-1000 transit and a Wild DM-1000 distance measuring device.

4.9 Aquifer Tests

Tests to determine in situ hydraulic conductivity were conducted in all borings. In C01, the bedrock portion of the hole was isolated with an inflatable packer and a pressure test was conducted. In all other holes, a metal slug was used to conduct falling and rising head tests. All of the tests were designed and supervised by hydrologists from Weston Geophysical Corporation. Field data and

plots of recovery versus time for each well are found in Appendix E.

4.9.1 Packer Test in C01

A single packer (St. Lawrence) test was used to evaluate the hydraulic conductivity of the Cambridge Argillite penetrated by hole C01. The packer consisted of 10 foot long 15/16 inch interior diameter pipe sections leading through an expandable rubber bladder (packer). The packer sealed off the section of the corehole to be tested and was inflated with compressed air supplied from the surface. The pipe was perforated below the packer to allow water supplied from the surface to flow into the borehole and the surrounding formation. The equipment layout is shown schematically in Figure 13.

After checking the accuracy of the water flow meter and water pressure gauge and measuring the water depth in the borehole, the packer and water pipe were placed in the hole. The packer was inflated at 68 feet, 7 feet below the bedrock surface, to isolate the bottom of the hole from any weathered fractured rock at the top of bedrock which would allow hydraulic communication with the overlying glacial till. Tests were conducted at 10, 21, 35, and 51 p.s.i. During each test, the change in water flow was recorded every 30 seconds for 5 minutes. After conducting the four tests, the hydraulic conductivity was calculated.

Hydraulic conductivity was calculated from the formula given in Earth Manual, page 576 (United States Bureau of Reclamation, 1974):

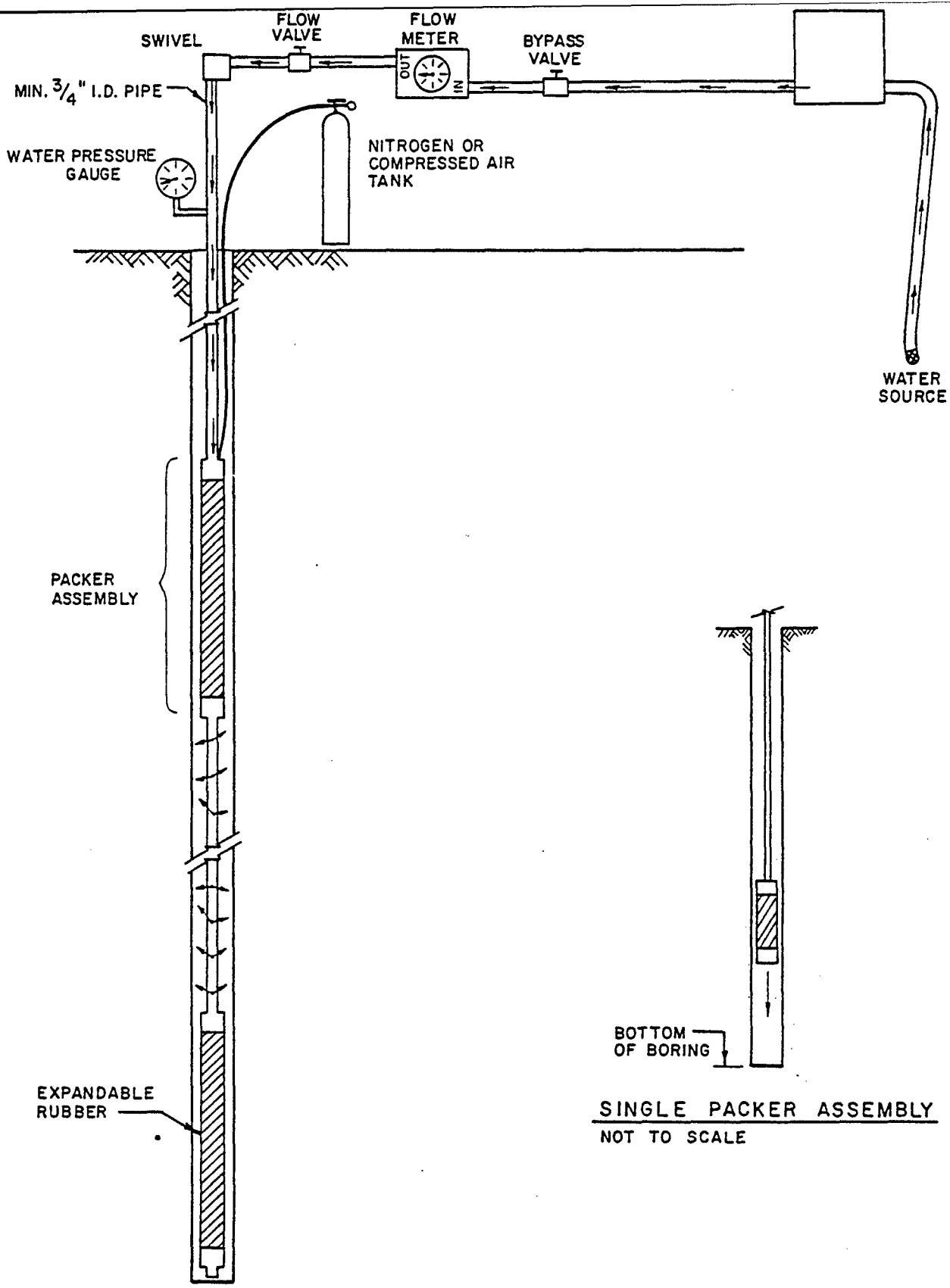
$$K = \frac{Q}{2\pi LH} \times \ln (L/R)$$

where K = hydraulic conductivity (gallons/minute/ft^2)
Q = constant rate of flow into the hole (gallons/minute)
L = length of the hole tested (feet)
h = differential head of water over distance from water table to water swivel (feet)
r = radius of hole (feet)

4.9.2 Monitor Well Slug Tests

A falling head and rising head slug test technique was used to evaluate in situ hydraulic conductivity. A solid 3 inch diameter PVC slug was used to displace the water in the well. In all but three wells a 5 foot long slug was used. In wells M03, M04, and M12, a 1½ foot long slug was used. This smaller slug was needed due to the smaller water column present in the wells.

After measuring the water level in the well, a transducer was lowered into the well to within a few inches of the base of the screen. All the pertinent test parameters were entered into a Hermit Environmental Data Logger Model SE1000B. At the start of the test, the slug was instantaneously lowered into the well until it was completely



DOUBLE PACKER ASSEMBLY
and ASSOCIATED APPARATUS

NOT TO SCALE

SINGLE PACKER ASSEMBLY

NOT TO SCALE

Source: Weston Geophysical Corporation

GEOLOGIC AND GEOPHYSICAL FIELD INVESTIGATIONS ARMY MATERIALS TESTING LABORATORY WATERTOWN, MASSACHUSETTS prepared for A. D. LITTLE, INC.	PACKER TEST EQUIPMENT SET UP Figure 13. 7/88

submerged. The height of the water column (above the initial reference level) was recorded on a logarithmic time scale by the Hermit as the water level recovered to its initial position.

After the water level stabilized in the well, a rising head test was conducted in a similar manner to the falling head test. The slug was instantaneous withdrawn from the well and the subsequent rise of water with time was recorded by the Hermit. After completing the falling and rising head test on each well, a hard copy of the recorded data was printed out for a quality review.

The method of Hvorslev (Freeze and Cherry, 1979, pp. 339-342) was used to calculate the hydraulic conductivities from the raw data collected. The maximum displacement of water, and subsequent recoveries relative to the maximum displacement, were plotted versus time on semi-logarithmic paper (Appendix E). From the resulting best-fit line, the time (T_o) for a relative displacement of 0.37 was calculated from the plot and entered into Hvorslev's formula:

$$K = r^2 \frac{\ln (L/r)}{2 L T_o}$$

where r = radius of well
L = height of water in borehole and well

The hydraulic conductivities calculated from rising head tests are generally more accurate than falling head tests with a partially penetrating well screen. However, the falling head tests can be used to check the accuracy of the rising head tests. That is, if the test results agree or the falling head test gives a slightly higher hydraulic conductivity, then the results are more likely to be accurate.

4.10 Physical Tests

Samples were taken for physical testing by the Weston Geophysical geologists during drilling. In compressible soils, a 2.875 inch I.D. Shelby tube sample was taken. In incompressible soils, a sample was taken using a conventional 2 inch O.D. split spoon. Shelby tube samples were capped and sealed with paraffin. Split spoon samples were placed in 2 inch clear glass jars. All samples were delivered to the Goldberg Zoino & Associates, Inc., Soils Laboratory in Newton, Massachusetts for testing. Data summaries and grain size plots are found in Appendix G.

4.10.1 Atterberg Limits

Atterberg limits (liquid limit and plastic limit) were determined for all samples except for M03 and M04 which were gravels and, therefore, too coarse grained for testing. Testing specifications are given in ASTM Volume 04.08, Procedure D4318-84.

The liquid limit is measured in a standard liquid limit device. The device essentially consists of a cup in which soil at various moisture contents is placed, the soil is grooved with a standard tool and the cup struck by a cam. The liquid limit is determined when the groove closes to a specified width at 25 blows. The soil is weighed, oven dried, and weighed again. The percentage of water by weight to dry weight of soil is the liquid limit.

The plastic limit is determined by rolling the soil into a 1/8 inch string. When the soil string begins to crumble (plastic limit), it is weighed,oven dried, and weighed again. The percentage of water by weight to dry weight of soil is the plastic limit. The plasticity index is the difference between the liquid limit and the plastic limit.

4.10.2 Specific Gravity

Specific gravity is determined by comparing the soil's weight in air against its weight loss in water. Testing specifications are given in ASTM Volume 04.08, Procedure D854-83.

4.10.3 Porosity

Porosity was calculated from determination of dry density and specific gravity in the following manner:

$P = ((1 - v_s)/v_s) \times 100$

P = porosity

$1\text{-}v_s$ = volume of pore space

v_s = volume of solid = dry unit wt/spec. gravity x unit wt water

4.10.4 Permeability

Permeability tests were performed on samples to reconstitute specified densities approximately equivalent to 95 percent of modified Proctor (ASTM Volume 04.08, Procedure D1557-78) at about 2 percent wet of optimum water content.

Reconstituted test specimens were prepared in a manner similar to that described in "Special Procedures for Testing of Soil and Rock for Engineering Purposes" STP 479, ASTM 5th Edition, pages 101-103. Each specimen was reconstituted in 2.0 inch diameter by 4.0 inch long sample formers. A specific amount of soil at the appropriate water content was weighed in five equal portions. Each portion was tamped by means of a mechanical tamping foot to a specified height in the mold. After five layers were compacted, the sample was weighed, measured, and its unit weight verified. After verification of the unit weight, the test sample was placed on a previously evacuated, modified triaxial cell base and porous stone. A membrane was added and the sample sealed top and bottom by 'O' rings.

Samples were back pressured under a small effective stress to create complete saturation of the sample. When the desired saturation was achieved, the samples were attached to the permeability apparatus and tested in accordance with procedures described in the Army Corps of Engineers Manual EM 1110-2-1906, Appendix VII, "Falling Head Permeability Tests with Back Pressure." Records of head change versus time were recorded for the test with the permeability value reported being the average of several consistent values obtained during the test.

4.10.5 Sieve Size Analysis

When both sieve and hydrometer analyses were required, a combined mechanical analysis was performed. This procedure is similar to ASTM Volume 04.08, Procedure D2217.66 (wet preparation of soil sample for grain-size analysis and determination of soil constants).

A representative portion of the minus No. 4 material was mixed with water so as to form a thin homogeneous slurry. The fines suspended in this slurry were then decanted into an empty hydrometer jar, and the mixing-decanting process repeated until most of the fines had been removed. Coarser fractions remaining after the decantation were then oven dried and sieved through a nest of screens (Nos. 10, 20, 40, 50, 100, and 200). Any material passing the No. 200 screen was added to the hydrometer jar containing the finer fraction. Hydrometer analysis of these fines was performed in the conventional manner.

5.0 DISCUSSION OF RESULTS

The purpose of this program was to provide a geologic and hydrologic characterization of the AMTL site which could be used as a framework to predict and explain the direction and rate of transport and extent of any contamination which might be found. Geologic characterization was achieved through careful logging of boreholes and coreholes, borehole geophysics, and a refraction seismic survey. Hydrologic characterization was achieved by physical characterization and testing of soil samples, measurement of the water level, and performing packed pressure tests and slug (falling and rising head) tests. From these measurements and observations, the following hydraulic parameters were calculated: gradient, flow direction, hydraulic conductivity, flow velocity, and flow rate.

While soil and groundwater samples were obtained as part of this program, chemical analysis of these samples and interpretation of contaminant transport and significance were not part of this program.

5.1 Geologic Characterization

Details of the geology at the AMTL have already been discussed in Section 3.0 Site Geology. Therefore, only a brief summary of the stratigraphic sequence is therefore provided here. Bedrock at the site consists of the Cambridge Argillite, a dense finely laminated siltstone consisting of bluish gray silt to clay beds with interbedded lighter colored, very fine to fine-grained, sandy beds. Most fractures are parallel to bedding, but other fracture orientations exist (fewer than four per foot). The siltstone is overlain by a basal, bouldery till with a gray green silt-rich sandy to gravelly matrix. It is fairly cohesive and dense. Laying on top of the till is a silty sand found across the site which is composed of moderately well sorted, very fine to fine-grained sand with a clayey-silty matrix. It is commonly laminated and locally becomes very silt/clay rich. Overlying the silty sand is a texturally variable layer of medium to coarse-grained sand and gravel which is not found over the entire site. It was not found in the northwest corner of the facility and it grades from a medium to coarse-grained sand to a gravelly sand eastward. This coarser unit over the silty sand commonly contains the first trace of water. The coarser sand/gravel layer is generally overlain by fill of disturbed gravels, commonly with exotic debris (concrete, brick, ceramic, etc.).

Additional geological information can be obtained from interpretation of the seismic refraction survey. The locations of the lines were shown in Figure 7 and the actual interpretative profiles in Figure 8. Profile 1 is characterized by four distinct seismic horizons. A material with velocities ranging from 1,000 to 1,800 feet/sec is seen from ground surface to a depth of 4 feet. These velocities are typical for fill material. This layer is underlain by a zone with a velocity of approximately 2,300 feet/sec, indicative of an

unconsolidated sediment. Included in this sequence is a water saturated zone at depths of 16 to 20 feet (from west to east, respectively). Unconsolidated, water saturated materials are characterized by seismic velocities of 5,000 feet/sec. Bedrock (siltstone) exhibits velocities of approximately 12,000 feet/sec. The bedrock surface varies in depth from 44 to 110 feet (Figure 8). Boring information obtained adjacent to Profile 1 indicates a thin, 6 foot basal till overlies the bedrock. This layer is not seen by the seismic method on Profile 1 because it is too thin to contribute significantly to the velocity plot.

Profile 2 is similar to Profile 1. Again, there are four distinct velocity zones. Between 14+00 and 23+00, the 1,000 to 1,800 feet/sec (fill) material is substantially thicker at 14 to 18 feet. The second horizon (unconsolidated sediments) appears to contain a facies change at approximately 24+50. From 14+00 to 24+50, the velocities are approximately 2,500 feet/sec which are indicative of a predominantly sandy environment. From 24+50 to 30+00, the sediment has a velocity of 3,000 to 3,500 feet/sec and is suggestive of a clay rich material. The water table is dipping slightly from north to south, towards the Charles River. Bedrock is relatively deep along the entire length of Profile 2. It varies from 85 to 115 feet and is characterized by a velocity of 11,000 feet/sec. The slightly lower velocity in the siltstone for Profile 2 (compared to Profile 1) can be attributed to the orientation of the survey line to the strike of the siltstone. Profile 1 is probably oriented parallel to the direction of the strike with Profile 2 oriented at some angle to strike. Profile 3 is characterized by a three layer seismic profile. A top layer of 1,200 to 1,900 feet/sec material is indicative of organic matter and fill. This layer extends to a depth of 8 to 10 feet. Water saturated material (5,000 feet/sec) is then observed to depths of 60-72 feet, the presumed top of the bedrock.

Borehole geophysical surveys were run in holes (C01 and C03). The original intent of the borehole surveys was to use logging techniques in deep holes cored into bedrock to determine physical properties of the unconsolidated glacial sediments and bedrock to provide stratigraphic correlation.

Hole C01 was drilled to a total depth of 78 feet, the lower 16.5 feet cored in bedrock. The steel casing extended to bedrock at 61 feet. Because of the steel casing, most information was obtained in the bedrock interval only. Caliper, natural gamma, short and long spaced gamma density, neutron, resistivity, spontaneous potential, temperature, and fluid conductivity logs were run.

The caliper log was only run in the open hole (59-75 feet) and indicated a void at 61-62 feet, probably a washout at the bedrock surface created during drilling. In the bedrock interval, the natural gamma log ranged from 50-60 cps (approximately 60% clay) relative to an average of 15 cps for the unconsolidated glacial sediments confirming the high potassium (clay) content of the bedrock. The

slight increase from 12-13 cps (approximately 25% clay) below 25 feet to 17-18 cps (approximately 35% clay) below 25 feet indicates increasing clay content at depth in the glacial sediments. Rapidly increasing values below 57 feet (>40-50 cps) indicate the clay rich nature of the basal till.

Short spaced density measurements give a density of approximately 2.2 g/cm^3 slightly below average (2.4g/cm^3) for a wet shale. The long spaced density measurements show relative density difference breaks that seem to correlate well with lithology:

(a)	0-25 feet	silty sand
(b)	25-45 feet	sand
(c)	45-50 feet	clayey sand
(d)	>56 feet	basal till

The spontaneous potential log shows a notable negative deflection for the siltstone. The neutron log shows discontinuities at approximately 25 feet, 52 feet, and 62 feet. The lower values in the interval 25-52 feet and at 62 feet reflect the higher porosity of the sand and a void respectively. Porosity of the silty sand and the siltstone appear comparable which is not likely. The till (56-61 feet) exhibits a porosity intermediate to the silty sand and sand.

Temperature and fluid conductivity both show gradual decreases as depth increases from about 28 feet (the water level). Temperature decreases from 55°F to 53°F and conductivity from approximately 25 to 15 ohm -m.

Hole C03 was bored to total depth of 37.5 feet terminating in basal till. It was cased with 4 inch PVC and screened from 24.6 to 34.6 feet. Logs included natural gamma short and long spaced gamma density, neutron, temperature, and conductivity.

The natural gamma log shows a broad peak centered at approximately 20 feet which expresses the presence of the bentonite seal from 17 to 22 feet. The low centered at 10 feet is an expression of the sandy peat from 8 to 15 feet. The long spaced gamma density correlates very generally with stratigraghy: a general low with several narrow peaks correlating with the silty sand (16-29 feet); and a broad peak correlating with a gravel (30-33 feet). Temperature varied from 56 to 58°F and conductivity was approximately constant at 10 ohm -m.

5.2 Hydrological Characterization

Details of the hydrology at the AMTL have already been discussed in Section 3.0, Site Geology. Only a brief summary of the hydraulic regime (Table 8) is presented here. Run-off of surface water is to the south toward the Charles River. Because of the extensive presence of structures and paving, most surface run-off is captured by the storm drain system and discharged to the river.

5-10 ft bore 7 E. Bore
1/5 (2nd) trans

TABLE 8. HYDRAULIC PARAMETERS

1. Gradient (i)

   a. West portion: 0.025 to south.

   b. East central portion: 0.030 to southeast, swings to 0.005 to south.

   ~0.0034

2. Hydraulic Conductivity (k)

   a. Silty sand:
      6.4×10^{-3} cm/sec (average)
      7.06×10^{-4} - 1.30×10^{-2} cm/sec (range).

   b. Medium-coarse sandy gravel:
      2.7×10^{-2} cm/sec (average)
      4.24×10^{-3} - 3.30×10^{-2} cm/sec (range).

   c. Siltstone:
      4.1×10^{-7} cm/sec (average)
      1.72×10^{-7} - 8.88×10^{-7} cm/sec (range).

3. Flow Rate (Q)

   a. 0.016 m^3/sec (98 gpm).

4. Flow Velocity (v)

   a. Site average: 4.5×10^{-4} cm/sec (142 m/year).
   b. Southeast portion: 4.5×10^{-5} cm/sec (14.2 m/year).

using $K = \frac{(2.7 \times 10^{-2})(0.0034)}{0.42} = 2.17 \times 10^{-4}$ cm/sec

$= 67.3$ m/year for Mid-Sand

Characterization of the groundwater hydraulics are based on 17 borings, 16 of which were completed as monitoring wells. Water level data, summarized in Table 5 and graphically interpreted in Figure 10 show groundwater flow is generally to the south toward the river. In the northeast corner, flow is to the southeast and then swings around to the south. The gradient averages 0.03 across the site, but in the southeast corner, it decreases to 0.003.

In situ hydraulic conductivities (k) were determined using falling and rising head tests. In the silty sand, which seems to be the dominant water-bearing unit over all of the site, k ranges from 7.06×10^{-4} to 1.30×10^{-2} cm/sec and averages 6.4×10^{-3} cm/sec. The medium to coarse sandy gravel has a range of k from 4.24×10^{-3} to 3.30×10^{-2} cm/sec with an average of 2.7×10^{-2} cm/sec. The siltstone (bedrock Cambridge Argillite) has an average k of 4.1×10^{-7} cm/sec, and is expected to effectively serve as a hydraulic barrier to the glacial sediment-hosted aquifer. We did not determine k for the basal till. Values reported in the literature for the Boston area (Hatheway, 1982) range from 10^{-5} to 10^{-9} cm/sec.

To calculate a representative flow rate (Q), a cross sectional area perpendicular to the gradient extending from near M01, then east to near M03, and finally northeast to near M08, approximately 2,000 feet was selected. The aquifer thickness (H) ranged from approximately 40 feet at the west to 47 feet at the east. We assumed that the siltstone provided an effective basal confining layer for the aquifer. The cross sectional flow area was estimated at 8080 m^2. Review of the drill logs and cross section M10-M07 (Figure 5) suggests that the silty sand is the predominate hydrologic unit. Review of the seismic Profile 1 (Figure 8) indicates most of the saturated zone is within a fairly uniform material, based on consistent seismic velocities of 5,000 feet/sec. Based on the preceding arguments, a hydraulic conductivity of 6.4×10^{-3} cm/sec, the average for the silty sand, was used. An average gradient (i) of 0.03 was selected. The flow rate, Q, can now be calculated:

$$Q = k\ i\ A$$
$$= 0.016\ m^3/sec\ (98\ gpm)$$
$$= 504576\ m^3/year\ (51{,}508{,}800\ gal/year)$$

Representative average linear velocities can be calculated by:

$$v = ki/n$$

Using an average porosity (n) of 0.43 for the silty sand, gradients (i) of 0.03 and 0.003 and the average hydraulic conductivity (k) for the silty sand, calculated flow velocities range from 4.5×10^{-4} cm/sec (142 m/year) to 4.5×10^{-5} cm/sec (14.2m/year) where 4.5×10^{-4} cm/sec is most representative over all but the southeast corner of the site. Since the average porosity (n) determined in laboratory testing is lower than the effective porosity, these average linear velocities represent lower limits of linear velocity.

These velocity estimates represent the rate at which the centroid of a contaminant plume would move in the absence of attenuating mechanisms such as adsorption by soil or degradation. Dispersion would cause the leading edge of a plume to travel faster, and the trailing edge to travel slower than the centroid. For example, the centroid of a plume could travel the 183 m from C02 to the southern site perimeter in approximately 18 years, using a velocity of 3.2×10^{-5} m/sec (10 m/year). Dispersion would decrease the time at which contaminants originating near C02 would reach the southern boundary and would also increase the time period over which contaminants might be detectable at the southern boundary.

Attenuation by soil adsorption or degradation, on the other hand, could potentially increase the travel time by an order of magnitude or more, depending on both the soil and contaminant properties.

Given the information obtained from the 17 borings and 16 monitor wells, the hydrologic regime at the AMTL appears relatively simple. The surficial aquifer is unconfined and is bounded by the underlying siltstone bedrock and flows south toward the river. Variation in the textural composition of the unconsolidated glacial sediments accounts for minor variations in gradient, hydraulic conductivity and flow velocity.

6.0 RECOMMENDATIONS

Our recommendations can be put in two general categories: general and site specific. General recommendations are based on our extensive experience in drilling thick sequences of unconsolidated glacial sediments. Site specific recommendations are based on our experience at the AMTL.

6.1 General

6.1.1 Well Finish

We recommend that all permanent monitoring wells constructed in an urban environment, or even a suburban environment be completed per our design of Figure 11. This type of well finish offers

(a) two levels of security (bolted manhole and padlocked steel casing);

(b) a flush finish that does not present a safety hazard;

(c) a flush finish that is aesthetic and does not detract from its surroundings, particularly important at the AMTL because of the historic nature of the buildings;

(d) four levels of protection for the well, gasketed manhole, steel casing security cap, drain at base of steel casing and a slip cover on the four inch PVC well casing.

6.1.2 Bedrock Holes

A common practice in drilling at a location where there is little to no information on depth to bedrock, depth to water table and the nature of the stratigraghy, is to attempt to drill one or more deep holes to bedrock, or into bedrock, to log and sample stratigraghy and to complete the hole s a monitor well. It is commonly perceived that this is a most economical way to get the maximum information, when in fact, it is often not.

It is generally more expedient and easier to drill at least one deep hole. Using a rotary bit and steel casing and sampling with a split spoon every 10 feet until bedrock is encountered, the hole can be rapidly advanced. Cuttings can be examined for general trends in geology although there is separation of fine particles.

When bedrock is encountered, reduction to the appropriate size diamond core barrel is required to get continuous core samples. If core samples are not required, the chips from rotary bit can be logged. We would recommend a packer test in competent bedrock to measure in situ hydraulic conductivity and determine if the bedrock serves as a hydraulic barrier to the aquifer in the overlying unconsolidated sediments.

Since the rotary drilling technique may not offer the same degree of security in preventing cross contamination within the hole, it is not recommended that soil samples for chemical analysis be taken. Installation of a monitor well may not be prudent. It would probably be best to bore an adjacent hole using hollow stem augers to a predetermined depth, collect soil samples for chemical analysis, and complete as a monitor well.

6.1.3 Ground Penetrating Radar Surveys

In an urban area like the setting for the AMTL, it is recommended that utility clearances by the gas, electric, and telephone companies and the installation facility people be followed by a ground penetrating radar survey to verify the accuracy of "known" locations and to search for forgotten utilities.

6.1.4 Seismic Refraction Surveys

The use of seismic refraction surveys to determine depth to bedrock, general stratigraphic units and whether or not these units are saturated is an excellent idea. The survey is very cost effective for the information obtained and can generally be run in urban environments.

6.2 Site Specific

6.2.1 Borehole Geophysical Surveys

Borehole geophysical surveys were run in holes CO1 and CO3 at the AMTL. Neither hole was very deep, 78 feet and 37.5 feet respectively. CO1 has to be logged with 28 feet of 10 inch hollow stem auger, 56 feet of 8 inch steel casing and 61 feet of 4 inch steel casing which created some shielding" for the borehole tools. Most information obtained from the borehole logs was redundant with that obtained from geological logging, and we do not recommend running borehole surveys in a similar situation.

6.2.2 Additional Drilling

While the interpretation of analytical results is not in the scope of the Arthur D. Little, Inc. contract, we know that CO2 is at least moderately contaminated by the benzene-xylene-toluene group. Additional monitor wells are recommended both up and downgradient to attempt to identify the potential source area and the geometry of the contaminant plume. If, in addition to the light fraction, a heavy fraction is discovered, such as chlorinated solvents, monitor wells testing various levels in the aquifer are recommended. And finally, to assist in an initial assessment of applicable technology for remediation, a series of pump tests should be conducted to determine appropriate groundwater extraction rates.

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APPENDIX A

Boring Logs

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-01
Page 1 of 6
Date Start 5/31/88
Date Complete

Client EG&G, IDAHO, INC.
Case No.

Project AMTL, WATERTOWN
Location SW CORNER BLDG 311

Contractor GZA DRILLING
Logged By R. PENDLETON, WESTON GEO.

Drill Method AUGER
Total Depth 78.2'
Hole Diameter 12 1/8" INCREASED TO

Drilling Additives NONE TO 54.6' THEN RECIRCULATED HYDRANT WATER TO 78.2'
Static Water Level

Sampling Method SPLIT SPOON, 140/6 HAMMER 30" DROP
Casing Size

Notes SEE "GENERAL DATA" SHEET; 2" TO 54.6' THE 5' CORE BARREL TO 78.2'

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0	0 - 2.0	1.6'	1-3 12-28	0 - 0.6 MODERATE BROWN (5YR 4/4) FN. SAND (TOPSOIL) WITH ROOTS, GRASS ON TOP, VERY LOOSE - LOOSE, DRY (PT) - (SP)
1.0	C1-01			0.6 - 1.6 MIX OF BROKEN CONCRETE, CEMENT, DK GRAY (N3) CINDERS, FN. SAND, BRICK, GRAVAL MEDIUM COMPACT - VERY COMPACT, DRY (GP)
2.0				FILL
3.0				
4.0	4.0 - 6.0	1.1'	4-7 8-12	0 - 0.5 GRAYISH BLACK (N2) FN. SAND, DRY (SW)
5.0	C1-02			NO BEDDING
				0.5 - 1.1 MODERATE YELLOWISH BROWN MED - CRS, SAND SOME GRAVAL, DAMP
6.0				NO BEDDING
				LOOSE - MED COMPACT THROUGHOUT HNU 0.6
7.0				
8.0				
9.0				
10.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-1
Page 2 of 10
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'	10.0-12.0	1.9'	6-8	0-0.4 INTERBEDDED PALE OLIVE (10Y 6/2) LIGHT OLIVE BROWN (5Y 5/6) AND LIGHT BROWN (5YR 5/6) CLAYEY FN-SANDY SILT, DRY
11.0'	C1-03		12-12	0.4-1.0 LIGHT OLIVE BROWN SILTY CLAY, DRY
PERCHED				1.0-1.5 LIGHT OLIVE BROWN FN-SANDY SILT, WET (PERCHED WATER)
12.0'				1.5-1.9 LIGHT OLIVE BROWN SILTY CLAY, DRY HNU 0.8 (ML)
	12.0-14.0	1.9'	9-12	(5Y 5/6)
13.0'	~~CA~~ ANAL 508, 509, 510, 511, 512, 513, 514		12-13	LT. OLIVE BROWN CLAYEY SILT WITH INTERBEDDED LIGHT BROWN (RUSTY) LAYERS MOIST. (CL)
				NOTE: SAMPLE TAKEN FOR CHEMICAL ANALYSIS
14.0'				
	14.0-16.0'	2.0	6-7	LT. OLIVE BROWN (5Y 5/6) THROUGHOUT
15.0	C1-04		12-14	0-1.0 CLAYEY SILT ~~WITH~~ WITH LIGHT BROWN (RUST) STAINING DRY
				1.0-1.5 FN. SAND SOME SILT, WET (PERCHED)
				1.5-1.7 CLAYEY SILT DRY (CL)
16.0				1.7-2.0 FN-SAND SOME SILT DRY HNU 0.6
17.0				
18.0				
19.0				
	19.0 21.0	2.0	2-2 3-5	~~WET THROUGHOUT~~ LT OLIVE BROWN THROUGHOUT
20.0	C1-05		VERY LOOSE-LOOSE	ALTERNATING SILTY CLAY, SILT LAYERS 0.1-0.2' WIDE. RUNNING FN-SAND LAYER AT 1.6 TO 1.8'; LIGHT BROWN STAINING IN SILT AND CLAY (CL) WET IN SILT AND SAND LAYERS
21.0				
				5/31/88
22.0				
23.0				
24.0				6/1/88

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-1
Page 3 of 6
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
24.0				
25.0	24.0 - 27.0' C-1 SHELBY TUBE-1	3.0'	PUSHED	DUSKY YELLOW (5Y 6/4) SILTY FN. SAND TR. CLAY, WET. - TOP OF TUBE (SM) LIGHT OLIVE GRAY (5Y 5/2) TO DUSKY YELLOW SILTY CLAYEY FN. SAND, WET - BOTTOM OF TUBE (SM)
26.0				
27.0				
28.0	27.3' - 29.3' C-1-D6	1.4'	9-9 15-16 MEDIUM COMPACT-COMPACT	0 - 0.5 LIGHT OLIVE GRAY (5Y 5/2) SILTY FN. SAND, WET, (SM) 0.5 - 0.8 LIGHT OLIVE GRAY SILTY CLAYEY FN. SAND WITH SILTY FN. SAND BEDDING (GOO' THICK) 0.8 - 1.4 LIGHT OLIVE GRAY SILTY FN. SAND (SM) WET THROUGHOUT, GRAVAL TOP WASH ON DISCARDED
29.0				
30.0				
31.0				
32.0			~~15-31~~ ~~17-18~~	
33.0				
34.0	33.0 - 35.0' C-1-07	0.4'	15-31 17-18 MED. COMP. COMPACT	0.4' LIGHT OLIVE GRAY SILTY FN SAND, WET (SM) POOR RECOVERY, MIXED WITH GRAVAL WASH
35.0				6/2/88
36.0				
37.0				
38.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-1
Page 4 of 6
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
~~38.0~~				
39.0	38.2' - 40.2' C-01-08	1.3'	14-18 22-22 MED. COMPACT-COMPACT	0-0.7 SILTY FN. SAND, PALE OLIVE (10Y 6/2) AND LIGHT BROWN (5YR 5/6) (SM) 0.7-1.0 CLAY AND SILTY FN SAND LAMINAE ALTERNATING, LIGHT OLIVE GRAY CLAY (5Y 5/2) AND LIGHT BROWN FN SANDY SILT 1.0-1.3 SILTY FN. SAND (AS 0-0.7') WET THROUGHOUT (SM) (CL) HNu Headspace 1.6
40.0				
41.0				
42.0				
43.0				
44.0				
45.0	44.7 - 46.7' C-01-09	0.6	9-13 18-21 MED. COMPACT-COMPACT	LIGHT OLIVE GRAY (5Y 5/2) ~~MOIST~~, WET THROUGHOUT. 0-0.1, 0.2-0.6 SILTY CLAY (CL) 0.1-0.2 SILTY FN. SAND (SM)
46.0				
47.0				
48.0	47.4' - 49.4' ~~C-01-10~~ C-01-10	C-1 GEOTECH-1 C-1 GEOTECH-2 C-1 GEOTECH-3 ~~0 (SHELBY)~~ 1.3'	MED. COMPACT-COMPACT ~~PUSHED (SHELBY)~~ 17-20 24-24	0-1.1 FN. SAND ~~SOME SILT~~ (SM) ~~NO RECOVERY~~ 60ppm HNu Head space 1.1-1.3 CLAY, LITTLE SILT, WITH LIGHT BROWN STAINING AT 1.1-1.2 DK. GRAY SPECKS (ORGANIC)? LIGHT OLIVE GRAY, WET THROUGHOUT (CL)
49.0				
50.0	47.4-50.4 SHELBY TUBE	0'	PUSHED	NO RECOVERY
51.0				
52.0				

Arthur D. Little, Inc.
SOIL BORING LOG — ℄ CORE SKETCH

Boring No. C-1
Page 5 of 10
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
52.0				
53.0	52.6-54.6 C-01-11	2.0'	23-28-47-57 COMPACT-VOLOMPACT	0-1.1 LT OLIVE GRAY (5Y 5/2) TO DUSKY YELLOW (5Y 6/4) SILTY CLAY, FAINT BANDING FN. SAND LAYER 1mm WIDE (CL) 1.1-2.0 LT. OLIVE GRAY FN. SAND SOME SILT & TR. CLAY MATRIX WITH 25% GRAVEL UP TO 1", SUBANGULAR TO ROUNDED, TILL? (SM) WET THROUGHOUT. HEADSPACE 7 ppm
55.0				6/3/88 SC REFUSAL
	54.3'-56.5' C-01-RC-1	1.1'	SPUN CORE BARREL	0-0.4 GRAVEL, BROKEN COBBLES OF GRANITE WHITE MATRIX (N9) DK. GRAY (N3) GRAINS, GREENISH GRAY (5G 6/1) BROKEN CORE WITH WHITE QUARTZ, SLATY CLEAVAGE, SCRATCH WITH KNIFE. TILL? (GP) 0.4-1.1 BROKEN CORE, NO BEDDING, MASSIVE, HARD, LIGHT BLUISH GRAY - MED BLUISH GRAY (5B 6/1), UNWEATHERED QUARTZITE? DIORITE? BOULDER FRACTURE SURFACE? WAVINESS?
56.0				
57.0	56.5' - 60.0' C-01-RC-2	0.9'	SPUN CORE BARREL	BROKEN COBBLES (15 PIECES) (GP) 3 PIECES LIGHT BLUISH GRAY QUARTZITE? WITH QUARTZ VEINING, BOULDER? 12 PIECES VARIABLE COLORED GRANITES TILL REDS, BROWN, WHITES, GRAYS
58.0				
59.0				
60.0				
61.0	58.9' - 61.1' C-01-RC-3	0.5'	SPUN CORE BARREL	12 PIECES BROKEN COBBLES, GRAVEL: TILL (GP) BOTTOM COBBLE ARGILLITE 0.1 THICK CORE, LIGHT BLUISH GRAY
TOP OF ROCK 61.0'	60.3'-~62' C-01-RC-4	0.8' (0.4' CORE)	SPUN CORE BARREL	6/6/88 11 PIECES (NOT FULL CORE DUE TO LOSS OF CIRCULATION) 4: GRANITE TILL, GRAVEL-COBBLES 6: GRAVEL BROKEN CORE ARGILLITE GRAY, SLATY CLEAVAGE DIPPING ~45°, HARD 1: 0.4' ARGILLITE CORE, LT BLUISH
62.0				
63.0	61.5-66.9' C-01-RC-5	4.8' 0.6' VOID AT 3.0-3.6'	SPUN CORE BARREL	MEDIUM BLUISH GRAY THROUGHOUT BROKEN ANGULAR COBBLES AND GRAVEL OVERLAYING 4.4' OF CORE - COBBLES AND GRAVEL PROBABLY FLOAT. ARGILLITE, REST OF CORE. ARGILLITE: ~45° CLEAVAGES WITH APROX. 12 FRACTURES ALONG CLEAVAGE, HARD, (CAMBRIDGE SLATE FORMATION).
64.0				
65.0				
66.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-1
Page 6 of 6
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
66.0				
67.0	65.9-68.8 C-01 RC-6	2.9'		AS ABOVE WITH FLOAT WHICH IS FALLEN DOWN HOLE, 0-0.5'. FRACTURES ALONG CLEAVAGE, MEDIUM BLUISH GRAY, NO BEDDING OBSERVED, ARGILLITE, FRACTURES AT ~~0.04, 0.7, 1.4, 1.6, 1.7, 1.9 ALL VERTICAL FROM 1.4 TO 1.7 ft~~ 0.5, 0.8, 1.2, 1.7, 2.3, 2.6.
68.0				
69.0	~~66.8~~ 68.7-73.7* C-01 RC-7	5.0'		AS ABOVE - 0.2' FLOAT GRAVEL MADE UP ~~ABO~~ OF ARGILLITE (~45°) 4.8' OF HIGH ANGLE FRACTURED MEDIUM BLUISH GRAY ARGILLITE "CAMBRIDGE SLATE" FRACTURES ARE APROX. PERPENDICULAR TO BEDDING. SOME BEDDING LAMINAE, ~1mm THICK FEW FRACTURE ALONG BEDDING - MAP VIEW OF BEDS - SOME OF PALE YELLOWISH BROWN (10YR 6/2) COLOR INDICATIVE OF IRON OXIDE DUE TO WATER SEEPAGE
70.0				
71.0				
72.0				bedding
73.0				
74.0	73.2'-78.2 C-01 - RC-8	0.15' OF GRAVEL 4.85' OF CORE		CORE BREAK 6/8/88 AS ABOVE - 0.15 FLOAT of ARGILLITE GRAVEL 4.85' OF MEDIUM BLUISH GRAY ARGILLITE "CAMBRIDGE SLATE" WITH FRACTURES PERPENDICULAR TO BEDDING BOTH AT HIGH ANGLE TO HORIZONTAL (HARD)
75.0				
76.0				
78.0				78.2' END OF BORING 6/8/88
79.0				
80.0				
81.0				

CORE SKETCH

RELATIVE - NOT TO SCALE

*NOTE: UNSURE OF MEASUREMENT SEE FIELD NOTES P. 32 BOOK II

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-2
Page 1 of 4
Date Start 5/25/88
Date Complete 5/27/88

Client EG&G IDAHO INC | Case No.
Project AMTL, WATERTOWN | Location SOUTH OF BUILD. 37 NW OF BUILD. 131 AT E. END OF ~~TRAFFIC~~ SOUTH TRAFFIC ISLAND
Contractor GZA, DRILLING | Logged By RICHARD PENDLETON
Drill Method AUGER | Total Depth 39.5' | Hole Diameter 12 1/8"
Drilling Additives NONE | Static Water Level
Sampling Method SPLIT SPOON 24"x | Casing Size —
Notes SEE DAILY DRILLING REPORT AND BORING LOG GENERAL DATA SHEETS

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0	0 - 2.0'	1.6'	3-3-9-12	0-0.5 Olive gray (5Y 3/2) Sand some gravel overlain with grass, organics, roots throughout, TOPSOIL
1	AMTL C-2-01			0.5 - 0.8 light olive brown (5Y 5/6) med. sand and gravel FILL
2				0.8 - 1.6 Dark Gray (N3) cinders, med sand, gravel, broken cobble, FILL broken concrete DRY THROUGHOUT (GP) HNU 0.5
3.0	2.0 - 4.0' AMTL-15, 16, 17, 22, 23, 24, 25 (chemical Analysis)	TWO SPOONS TAKEN: 1.5' (1) 0.5' (2)	17-25 31-37 (1) 8-11-13 16 (2)	FILL - mix of broken cobbles and sand and gravel - taken for chemical sample
4.0				HNU not taken
5.0	4.0-6.0 C-2-02	1.2'	17-35 47-58	MIX OF BROKEN COBBLES AND GRAVEL OF VARIABLE COLORS REDS, BLUES, WHITES IN A MATRIX OF OLIVE BROWN MED. SAND, DRY, FILL NO BEDDING 50% MED SAND 50% GRAVEL BROKEN CONCRETE & brick pieces (GP)
6.0				HNU not taken
7.0	6.0-8.0' AMTL-26 THRU 33	1.0'	69-107 refusal at 7.0' brick	LT. OLIVE BROWN (5Y 5/6) MED-CRS SAND SOME GRAVEL, DRY, NO BEDDING (SW)
8.0				
9.0	AMTL-26-32 8.0'-16.0	2.0' (1) 1.8' (2) 0.4' (3)	17-23 24-25 2.16-20 23 26 3.16-16 20-18	LT. OLIVE BROWN MED. CRS SAND SOME GRAVEL, DRY, NO BEDDING (SW)

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-2
Page 2 of 4
Date Start –
Date Complete

Client EG&G, IDAHO, INC
Case No.

Project AMTL, WATERTOWN
Location SOUTH OF BUILD. 37 NW OF BUILD. 131 AT E. END OF TRAFFIC ISLAND

Contractor GZA DRILLING
Logged By RICHARD PENDLETON

Drill Method AUGER
Total Depth 39.5'
Hole Diameter

Drilling Additives
Static Water Level

Sampling Method SPLIT SPOON
Casing Size

Notes

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10	~~9-11~~ ~~22-22~~ 10-12 C-2-03	1.6'	9-17 22-26	LT. OLIVE BROWN (5Y 5/6) MED SAND SOME ~~WITH~~ VARIABLE COLORED COBBLES, LESS GRAVEL CFILL TRACE SILT SOME BROKEN COBBLE DRY, ANGULAR TO SUB ANGULAR (SW)
12				
13				
14				
15	14-16 C-2-04	2.0'	8-12 12-16	DUSKY YELLOW (5Y 6/4) TO GRAYISH YELLOW (5Y 8/4) WELL SORTED MED SAND WITH BROKEN COBBLE AT 1.5'. SOME VARIABLE COLORED SANDS RED BLUE WHITE THROUGHT FAINT RUSTY OXIDE AT 1.3', SUB ROUNDED THROUGHOUT, DRY (SW)
16				
17				
18				
19				
20	19-21 C-2-05	1.0'	10-28 38-40	DUSKY YELLOW TO GRAYISH YELLOW MED SAND WITH SOME VARIABLE COLORED SAND (SW) LITTLE BROKEN AT 0.5'

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-2
Page 3 of 4
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
20.0'	19.0-21.0' C2-05			{see description previous page} medium compact - very compact
21.0'				
22.0				
23.0				
24.0	24.0-26.0' C2-06 ~~1 THRU~~ 1 THRU 6	2.0'	17-17 39-42	DUSKY YELLOW (5Y 6/4) THROUGHOUT WITH VARIABLE COLORS 0-0.5' 0-0.5 MED-CRS SAND, DRY, WELL SORTED NO BEDDING (POSSIBLE FLOAT?) (SW) MEDIUM COMPACT - VERY COMPACT 0.5-2.0 INTERBEDDED FN SAND AND SILT WITH A OLIVE GRAY CLAY AT 1.8-1.9' MOIST FROM 1.9-2.0 - ODOR (GAS?) (SP) (SM)
26.0				
27.0	26.0-28.0' C2-~~08~~ OC ~~LEG TEST~~ SAMPLES 1 THRU 7 ~~C2 G1-1~~ ~~C2 G1-2~~ ~~C2 G1-3~~	2.0'	16-18 20-21	
28.0				
29.0				
30.0	29.0-31.0' C2-07-1 THRU 3 AMIL 501-507	2.0'	7-12 27-31	0-0.8 DUSKY YELLOW - OLIVE BROWN SILTY FN. SAND TR. CLAY (SM) 1.8-2.0 MED-CRS DUSKY YELLOW SAND SOME GRAVEL. (SP) MEDIUM COMPACT - VERY COMPACT
31.0				
32.0				
33.0				
34.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-02
Page 4 of 4
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
35.0				
36.0				
37.0				
38.0				
39.0				AUGERED TO 39.5' NO SAMPLES FROM 31.0 - 39.5'
40.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-3
Page 1 of 4
Date Start 6/15/88
Date Complete 6/17/88

Client EG&G IDAHO, INC.
Case No.
Project AMTL, WATERTOWN
Location SE CORNER AMTL, W. OF SE GATE 20' SE OF MW-6
Contractor BZA DRILLING INC.
Logged By RICHARD PENDLETON (WCC)
Drill Method AUGER 6¼ I.D.
Total Depth 37.5 HSA 39.5 SS
Hole Diameter 9½"
Drilling Additives NONE
Static Water Level 9.6'
Sampling Method 24" x 1⅜" ; 24" x 2⅜" (BIG)
Casing Size —
Notes 140lb WEIGHT 30" DROP

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0	0.0'-2.0' AT C3-01 C3-01A	1.5'	4-6 8-11 LOOSE-MED. COMPACT	0-0.8' DARK YELLOWISH BROWN (10YR 4/2) TOPSOIL, WITH ORGANICS, GRASS 0.5-1.5' GRAYISH YELLOW (5Y 8/4) MED. SAND TR. GRAVEL. (SP) 3PPM
2.0 FILL				
3.0				
4.0	4.0-6.0' C3-02 C3-02A	1.0'	3-3 3-4 LOOSE	0-0.6 DARK YELLOWISH BROWN MED. SAND SOME GRAVEL TR. SILT RMP (SP) 0.6-0.8 GRAYISH BLACK (N2) AND WHITE (N9) CINDERS 0.8-1.0 GRAYISH YELLOW MED-CRS. SAND SOME GRAVEL DRY 3-4PPM
6.0 FILL	ESTIMATED FROM WETNESS ON SPOON			
7.0	7.0'-9.0' AMTL 530 THRU AMTL 534	0.7'	9-9 12-14	GRAYISH BROWN (5YR 3/2), WET, MED SAND GRAVELLY SAND, WOOD PIECES (SP)
8.0 FILL				
9.0	9.0-11.0' C3-03	1.5'	1-2 1-2	BROWNISH BLACK ON SURFACE (Pt) GRAYISH BROWN ON INSIDE WHEN FIRST EXPOSED TO AIR. GRAVELLY CRS SANDY PEAT, ROOTS THROUGHOUT, WET
10.0 PEAT				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-3
Page 2 of 4
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0' ▽	9.0'-11.0'	WATER LEVEL IN AUGERS 6/17		- CONTINUED FROM PREVIOUS PAGE - TR. GRUB (AT 1.3'), GRAVEL MOSTLY AT TOP 0.2'
11.0'				
12.0	C3 - SHELBY #1 11.0'-13.0'	1.7'	PUSHED	6/15/88 HSA AT 9.0' WET THROUGHOUT (Pt) SANDY PEAT, SOME SILT, LITTLE GRAVEL MODERATE BROWN (5YR 4/4) AND GRAYISH BLACK (N2) ORGANIC SULFUR ODOR
13.0				
19.0'				
15.0 PEAT	C3-04 14.0'-16.0'	0.9'	1-1 1-8 V. LOOSE TO MED. COMPACT	0-0.3 GRAYISH BLACK SANDY PEAT, SOME SILT, WET (Pt) 0.3-0.8 DARK YELLOWISH BROWN (10YR 4/2) SILTY FN-MED. SAND WET SUB ROUNDED ORGANICS 0.8-0.9 GREENISH GRAY (5G 6/1) (SM) SILTY FN. SAND WET ANGULAR 1.8 PPm
16.0				
17.0				
18.0				
19.0 INTERBEDDED SILTY FN. SAND AND CLAY				
20.0	C3-05 19.0'-21.0'	1.3'	WOR-8 9-9 LOOSE-MED. COMPACT.	0-1.0' PALE OLIVE (10Y 6/2) SILTY FN. SAND, WET (SM) 1.0-1.3' PALE OLIVE SILTY CLAY TR. V. FINE SAND, WET 0.5 PPm
21.0				
22.0				
23.0				
24.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-3
Page 3 of 4
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
24.0' — SILTY SAND, GRAV.	C3-06 24.0' – 26.0'	2.0'	3-7 22-28 LOOSE – M. COMPACT	0-0.2 MED.-CRS SAND SOME SILT MED. DARK GRAY SOME GRAVEL (SM) 0.2-1.2 GREENISH GRAY SILTY CLAY (CL) SOME THIN LAMINAE OF MED SAND. SOME GRAVEL 1.2-2.0 DUSKY YELLOW WITH THIN DARK YELLOWISH BROWN (10YR 4/2) LAYERS AT 48° GRADES FROM SILTY FN. SAND TO WELL GRADED CRS. SAND AT BOTTOM (SM)
26.0				
27.0				
28.0				
29.0				
SANDY GRAVEL	29.0' – 31.0' C3-07 C3-GEOTECH-1 C3-GEOTECH-2 C3-GEOTECH-3	1.1'	5-10 11-13 LOOSE – MED. COMPACT	0-0.3 FN.-CRS SAND WET LITTLE SILT LITTLE GRAVEL (SM)-(SP) 0.3-1.1' SANDY GRAVEL, LITTLE SILT, WET (GP) GRAVELS OF VARIABLE COLORS BLUES, REDS, LT. BROWNS SAND MATRIX OF LT. OLIVE GRAY TO OLIVE GRAY (5Y 5/1)
30.0				
31.0				
32.0				
33.0				DRILLER FELT DEFINITE CHANGE IN AUGERS – POSSIBLE TILL BOUNDARY
34.0 — GRAVELLY SAND & TILL?	AT 34.0' C3-08	1.0'	W.O.R. HEAVED TO 29.0'	SILTY GRAVELLY SAND, WET. LT. OLIVE GRAY (GP)
35.0				
36.0				
37.0				
38.0 — TILL	37.5' – 39.5' C3-09	1.7'	W.O.R. – 47-31 33	0-0.6' SILTY CRS. SAND, SOME GRAVEL DARK YELLOWISH BROWN CLAYEY (GC) 0.6-1.7' GREENISH GRAY (5G 6/1) TILL A SILTY FN. SAND, ANGULAR, SOME GRAVEL OF WIDE SIZES

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. C-3
Page 4 of 4
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
38.0	37.5 - 39.5			SEE DESCRIPTION PREVIOUS PAGE
39.0 FILL				
40.0				6/16/88 SS. HSA AT 37.5'
41.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. M01
Page 1 of 1
Date Start 5/17/88
Date Complete 5/17/88

Client E6 & G | Case No.

Project AMTL, WATERTOWN | Location ~~WATERTOWN~~ SW BUILD. 39

Contractor GZA DRILLING | Logged By R. PENDLETON

Drill Method AUGER | Total Depth ~~16.5~~ (RMP) 17.5' (TRW) | Hole Diameter 1.0'

Drilling Additives NONE | Static Water Level 8'

Sampling Method SPLIT SPOON (2') | Casing Size

Notes ~~8" I.D.~~ 8¼" HD. AUGER 12" O.D. 140lb 30" DROP HNU readings in ppm/Millirem radiation in counts per minute

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION (HNU)
0	0-2'	1.3'	1-4 7-6	0.7' DK. BROWN FN. SAND, TOPSOIL, GRASS, 0.2' MED. SAND, POORLY CEMENTED, SOFT, 0.3 FN. SAND SOME SILT, SOME GRAVEL M01-1
4	2-4'	0.9'	6-4 5-10	ORANGISH BROWN (5YR 3/2) SILTY SAND ~~SLGT CLAY~~ ~~CL~~ SM MOIST, SOME GRAVEL, SOFT, POORLY CEMENTED, CHEMICAL SAMPLE TAKEN ~~M01-2~~ HNU (1)
6	4-6'	1.0'	12-11 11-8	DUSKY BROWN (5YR 2/2) MED. SAND (SM), DRY, SOFT POORLY CEMENTED, (HNU: 0.5) M01-2
8				6' DUSKY DK BROWN SAND, GRAVEL FROM AUGER 7' WET DUSKY BROWN HNU 0.5 RAD 50 CPM TOO COMPACT (COBBLE?) FOR SHELBY
10	9'-11'	1.7'	8-13 11-12	DUSKY YELLOW, WET THROUGHOUT M01-3 0.2 MED-CRS SAND (SM) 0.3 SILTY ~~CLAY~~ FN. SAND (SM) 0.4 FN. SAND (SM) 0.8 SILTY ~~CLAY~~ FN. SAND (SM) SHELBY TUBE 11-13', 24" RECOVERY
12				11'-13' 2 VOA's, 1 METALS TAKEN
14	14.5-16.5	2.0'	6-8 13-14	DUSKY YELLOW, DAMP, CLAYEY SILT SOME FN. SAND, FAINT LAMINAE OF FN. SAND M01-4
16				
18				17.5' END OF BORING RMP TRW

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MØ-02
Page 1 of 2
Date Start 5/20/88
Date Complete 5/23/88

Client E.G.+G. IDAHO, INC. | Case No.

Project AMTL WATERTOWN, MA. | Location SO. OF BLDG 292, ALONG FENCE, IN GRASS

Contractor GZA DRILLING | Logged By JEFFREY W. FORTNER (WESTON GEOPHYSICAL)

Drill Method AUGER | Total Depth 16.27' | Hole Diameter 12 1/2"

Drilling Additives NONE | Static Water Level 8.85'

Sampling Method SPLIT SPOON + SCHELBY TUBE | Casing Size 4" PVC

Notes WEATHER: OVERCAST, 50°, WET.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0.0'	0.0'-2.0'	11"	1-2-2-3	0.0-0.7 (TOP SOIL) DUSKY BROWN SILTY SAND WITH ORGANICS. ≈5% GRAVEL. 5YR 2/2 (DL)
1.0'	MØ2-01		---	0.7'-11" - MODERATE 10YR 5/4 YELLOWISH BROWN POORLY SORTED MED-COARSE SAND WITH ≈20% GRAVEL AND <5% SILT. (FILL) (SW)
2.0'				VERY LOOSE COMPACTION HNu = 0.8
	2.0'-4.0' AMTL-009 AMTL-010 AMTL-011 CHEM. ANALYSIS 12:NOON	1.1'	20-30-33 -27	PALE 10YR 6/2 YELLOWISH BROWN POORLY SORTED FINE-COARSE SAND. LITTLE TO NO SILT. ≈40% ANGULAR ROCK FRAGMENTS (FILL). (SP) 97 (SW)
3.0'				
4.0'				VERY COMPACT HNu = 0.8
	4.0'-6.0' MØ2-02	1.8'	47-67-96 -109	VARIOUS MOTTLED ORANGE + BROWN COLORS (FILL), POORLY SORTED FINE-COARSE SAND. LITTLE TO NO FINES. ≈50% ANGULAR ROCK FRAGMENTS. (SW)
5.0'				
6.0'				VERY COMPACT HNu = 0.5
7.0'				
8.0'				
	8.0'-10.0' MØ-03	1.7' WET ON SPOON	12-63-51 -47	VARIOUS MOTTLED ORANGE + BROWN COLORS (FILL), POORLY SORTED FINE-COARSE SAND. LITTLE TO NO FINES ≈ 50% ANGULAR ROCK FRAGMENTS. WETNESS ON SPOON @ 8.9'. (SW)
9.0'				
10.0'				HNu = 0.5 ppm VERY COMPACT

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MB-02
Page 2 of 2
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'				
11.0'	FILL CLAY			
12.0'				
13.0'				
14.0'	14.0'-16.0' MB2-04	24"	3-6-8-13	LIGHT OLIVE GRAY INTERBEDDED SILTY CLAY, AND CLAYEY SILT WITH A TRACE OF VERY FINE SAND. COLOR: 5Y 5/2 (OL) LOOSE COMPACTION HNu - 0.8ppm
15.0'				
16.0'	16.0'-18.0' ~~RECOVERY 17~~ SCHELBY TUBE SH-3	24"	PUSHED	APPEARS TO BE SAME AS ABOVE
17.0'				
18.0'				
19.0'				
20.0'				
21.0'				
22.0'				
23.0'				
24.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MW-3
Page 1 of 3
Date Start 6/13/88

Client EG&G, IDAHO, INC. | Case No. | Date Complete 6/13/88

Project AMTL, WATERTOWN | Location SOUTH BUILD 36

Contractor G2A DRILLING | Logged By RICHARD PENDLETON (WGC)

Drill Method AUGER | Total Depth 27.5' MSA 29.5' SS | Hole Diameter 12 1/8"

Drilling Additives NONE | Static Water Level 20.5' - 1417 - 6/13

Sampling Method SPLIT SPOON 24" x 1 3/8" 24" x 2 1/2" "SC" | Casing Size —

Notes

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0'	0.0' - 2.0' M3-01	1.0'	1-3 9-14 V. LOOSE - MED. COMPACT	DARK YELLOWISH BROWN (10YR 4/2) TO DUSKY YELLOWISH BROWN (10YR 2/2) SILTY FN. - MED SAND, DRY, 0.2' COBBLE AT BOTTOM, ORGANICS (ROOTS GRASS : TOPSOIL) TO P 0.5' DRY (GM) BACKGROUND
1.0'				
2.0'				
				3.0' DUSKY YELLOWISH BROWN FN-SAND, GRAVAL, COBBLES, RED BRICK, FROM AUGER.
3.0'				
4.0'	4.0' - 6.0' M3-GEOTECH-1, M3-GEOTECH-2, M3-GEOTECH-3 M3-02	1.5'	18-25 32-37 MED. COMPACT - V. COMPACT	FN. - CRS SILTY SAND AND GRAVAL, BROKEN COBBLES, MODERATE YELLOWISH BROWN (10YR 5/4) SOME GRAVAL OF MED. BLUISH GRAY (5B 5/1) (ARGILLITE?) DRY (GM) BACKGROUND
5.0'				
6.0'				
7.0'				
8.0'				
9.0'				
	9.0' - 11.0' M3-03	1.6'	15-27 32-35 MED. COMPACT V. COMPACT	CRS. SAND AND GRAVAL, GRAVAL OF MED. BLUISH GRAY COLOR, SAND OF MODERATE YELLOWISH BROWN, SAND WELL SORTED SUB ANGULAR DRY. (GP) BACKGROUND
10.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MW-3
Page 2 of 3
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'				SEE DESCRIPTION PREVIOUS PAGE
11.0'				
12.0'				
13.0'				
14.0'				
	14.0-16.0' AMTL-518 THRU AMTL-524 MW3-04	1.7' "BIG SPOON"	15-20 30-31 MED COMPACT-V. COMPACT	0-0.5' CRS. SAND AND GRAVAL, SOME COBBLES MODERATE YELLOWISH BROWN 0.5-1.7' ~~FINE~~ RWP SILTY, FN SAND, DRY, MODERATE OLIVE BROWN (5Y 4/4) TR. CLAY THIN (< 1mm) FN. SAND LAMINAE
16.0'				
17.0'				
18.0'				
19.0'			18-20 22-26 MED COMPACT-V. COMPACT	
	19.0-21.0' MW3-05 AMTL 525 THRU AMTL 529	1.6' "BIG SPOON"		MODERATE OLIVE BROWN TO GRAYISH OLIVE (10Y 4/2) FN. SAND & SOME SILT SOME CLAY, ALTERNATES WITH SILTY CLAY LAMES, WET ESPECIALLY IN FN. SAND.
21.0'				
22.0'				
23.0'				
24.0'				

Arthur D. Little, Inc.

SOIL BORING LOG

Boring No. MW-3
Page 3 of 3
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
Ø24.0'	24.0 - 26.0' MW3-06	1.5'	8-9 16-16 MED. COMPACT-COMPACT	DUSKY YELLOW (5Y 6/4), WET THROUGHOUT 0-0.8 SILTY FN. SAND 0.8-1.2 SILTY CLAY 1.2-1.5 SILTY FN. SAND NO HNU CHECK
25.0				
26.0				
27.0				END OF BORING - HSA - 6/13/88
28.0'	27.5' - 29.5' MW3-07	1.8'	4-6-6-8 V. LOOSE-MED. COMPACT	DUSKY YELLOW, WET THROUGHOUT 0-0.5, 0.6-0.9, 1.2-1.4, 1.5-1.8 SILTY FN. SAND, WITH UNSORTED LIGHT BROWN LAYER (2mm THICK) AT BOTTOM OF LAYER 0.5-0.6, 0.9-1.2, 1.4-1.5 SILTY CLAY NO HNU CHECK
29.0				
30.0				BOTTOM OF SPLIT SPOON - 6/13/88

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MW-4
Page 1 of 3
Date Start 6/9/88
Date Complete 6/10/88

Client EG&G, IDAHO, INC
Case No.
Project AMTL, WATERTOWN
Location SW BUILDING 60
Contractor GZA DRILLING
Logged By RICHARD PENDLETON (WGC)
Drill Method AUGER
Total Depth 85.0' HSA 37.10' SS
Hole Diameter 12 1/8"
Drilling Additives NONE
Static Water Level 1130 6/10 28.85'
Sampling Method 24" SPLITSPOON "BIG SPOON" 24 x 2 1/2" DITERUNGE 24 x 1 1/2" SPOON
Casing Size
Notes 140lb WEIGHT, 30" DROP

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0	0.0 - 2.0' MW-01	1.0'	1-3 5-7 V. Loose - med. compact	0-0.5 GRASS, ORGANICS, GRAVELLY SAND, GRAYISH BROWN (5YR 3/2), ORANGE SPRAY PAINT DRY 0.5-0.7 MED-CRS SAND, VERY PALE ORANGE (10YR 8/2) DRY (SW) FILL 0.7-1.0 GRAYISH BROWN SANDY FN. SAND AND BROWNISH BLACK CINDERS? (5YR 2/1) TR. GRAVEL DRY
2.0				
3.0				
4.0	4.0 - 6.0 MW-02 AMTL-515 AMTL-516 AMTL-517	1.3' Big Spoon	4-5 6-4 Loose - med. compact	GRAYISH BROWN (5YR 3/2) FN-MED SAND SOME GRAVEL, DRY, (SW) NO BEDDING, ROUNDED GRAINS Headspace 7.8 ppm
6.0				
7.0				DK. BROWN SAND from AUGER
8.0				
9.0	9.0 - 10.0'	1.3'	14-21 27-38 med compact - v. compact	MODERATE BROWN MED SAND AND GRAVEL WITH COARSE GRAVEL OF VARIOUS COLORS, BROWNS, BLUES AT 0.2' FN SAND (0.1' THICK) OF GRAYISH OLIVE GREEN (5GY 3/2)
10.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MW-4
Page 2 of 3
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'	MW-03			SEE DESCRIPTION PREVIOUS PAGE
11.0'				
12.0'				
13.0'				
14.0'	MW-04 MW GEOTECH-1 MW GEOTECH-2 MW GEOTECH-3 MW 14.0'- 16.0'	1.0' BIG SPOON	20-28 54-64 COMPACT- V. COMPACT	LT. BROWN (5YR 6/4) CRS. SAND, GRAVEL AND COBBLES FILL, DRY, NO BEDDING, (GW)
15.0'				
16.0'				
17.0'				
18.0'				
19.0'				
20.0'	20.0'- 21.0' MW-05	1.2'	15-17- 25-25 MED. COMPACT- V. COMPACT.	LT. BROWN ~~CRS~~ MED. CRS SAND, SOME GRAVEL OF VARIABLE COLORS, NO BEDDING, BROKEN COBBLE, DRY, FILL, (SW)
21.0'				
22.0'				
23.0'				
24.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No.
Page 3 of 3
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
24.0				
25.0	24.0-26.0' M4-06	2.0'	12-16 28-28 MED. COMPACT-V. COMPACT	~~0.0-0.4~~ 1.0-3.0' YELLOWISH GRAY (5Y 7/2) SILTY FN-SAND AND D-0-1.6' GRAVEL, DRY, ~~0.4-2.0~~ PALE YELLOWISH BROWN (10YR 6/2) WELL SORTED CRS SAND, GRAVEL DRY NO BEDDING OBSERVED (SW) SPOON TOP: V. COMPACT DRY GRAYISH ORANGE, SILTY FN. SAND
26.0				
27.0				
28.0				
29.0	29.0'-31.0' M4-07	1.5'	6-12 18-19 MED. COMPACT-COMPACT	SILTY FN. SAND, DUSKY YELLOW (5Y 6/4) {MICA FLAKES} ~~Sand~~ IN SAND, WET, NO BEDDING (SM)
30.0				
31.0				6/9/88
32.0				
33.0				
34.0				
35.0	35.0'-37.0' M4-08	2.0'	6-8 12-14 MED. COMPACT	DUSKY YELLOW (5Y 6/4), WET, THROUGHOUT 0-0.9 SILTY FN. SAND W/ MICA FLAKES (CL-ML) 0.9 V. DUSKY RED (10R 2/2) THIN LAYER ERODED PEAT SURFACE? ORGANICS? 0.9-1.1 CLAY SOMESILT (SM) (SC) 1.1-1.4 SILTY FN. SAND SOME CLAY 1.4-1.6 CLAY SOME SILT 1.6-2.0 SILTY FN. SAND
36.0				
37.0				END OF BORING 6/10/88 HSA TO 35.0' SPOON TO 37.0'
38.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MB-05
Page 1 of 2
Date Start 6/13/88
Date Complete ~~6/13/88~~ 6/14/88

Client E.G. & G. IDAHO, INC. | Case No.

Project AMTL WATERTOWN, MA. | Location GRASS TERRACE BETWEEN STORAGE TANKS AND N. BECON ST.

Contractor GZA DRILLING, INC. | Logged By JEFFREY W. FORTNER WESTON GEOPHYSICAL CORP.

Drill Method AUGER | Total Depth 23.0' | Hole Diameter 12 1/8"

Drilling Additives NONE | Static Water Level 9.97'

Sampling Method SPLIT SPOON | Casing Size 4" PVC

Notes

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0.0'	0.0'-2.0' MB5-01	0.8'	3-5-4-5	DUSKY BROWN (5 YR 2/2) FINE TO MEDIUM SAND W/ SILT. ≈ 10% GRAVEL. ORGANICS ABUNDANT (TOP SOIL). (GM) VERY LOOSE COMPACTION
1.0'				
2.0'				
3.0'				
4.0'	4.0'-6.0' MB5-02	1.3'	2-3-5-6	DUSKY BROWN (5 YR 2/2) POORLY SORTED SILTY SAND W/ ≈ 30% GRAVEL. (FILL) COBBLES PRESENT IN DRILL CUTTINGS. (GM) VERY LOOSE COMPACTION
5.0'				
6.0'	6.0'-8.0' AMTL-043 V AMTL-045 SVP AMTL-046 SVP 8:05	1.8'	7-8-8-7	GRAYISH BROWN (5 YR 3/2) POORLY SORTED SILTY SAND W/ ≈ 30% GRAVEL. (FILL) COBBLES PRESENT IN DRILL CUTTINGS. SOME SLAG. (GM) LOOSE COMPACTION
7.0'				
8.0'	8.0'-10.0' AMTL-044 AMTL-047 AMTL-048 AMTL-049 MB5-03 8:20	1.5'	8-17-35 -26 3" DIA. SPOON	GRAYISH BROWN (5 YR 3/2) POORLY SORTED SILTY SAND W/ ≈ 40% GRAVEL W/ COBBLES. (FILL) SLAG PRESENT. @ 9.5', A LARGE FRACTURED ROCK WAS ENCOUNTERED (GM) COMPACT
9.0'				
10.0'				

4 9 11 12

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MØ-05
Page 1 of 2
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'				
11.0'				
12.0'	JET ON ROD 12'2" ▽			
13.0'				
14.0'				
	14.0'-16.0' MØ5-04 ATTERBURG LIMITS SIEVE ANAL. SPEC. GRAV.	2.0'	4-9-11-12	MODERATE YELLOWISH BROWN (10 YR 5/4) WELL SORTED MEDIUM SAND W/ LITTLE TO NO FINES. (SW) MEDIUM COMPACT
15.0'				
16.0'				
17.0'				
18.0'				
19.0'				
	19.0'-21.0' MØ5-05	2.0'	7-9-19 -27	MODERATE YELLOWISH BROWN (10 YR 5/4) WELL SORTED MEDIUM SAND W/ LITTLE TO NO FINES. TO FINE (SW) MEDIUM COMPACT
20.0'				
21.0'				
22.0'				
23.0'	T.D. H.S.A.			
24.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MW-06
Page 1 of 2
Date Start 5/26/88
Date Complete

Client E.G. + G. IDAHO, INC.
Case No.

Project AMTL WATERTOWN, MA.
Location SOUTH OF EXPLOSIVE BUNKERS ≈ 70'

Contractor GZA DRILLING
Logged By J.W. FORTNER (WESTON GEOPHYSICAL)

Drill Method AUGER
Total Depth 19.0'
Hole Diameter 12 1/8"

Drilling Additives NONE
Static Water Level 7.3'

Sampling Method SPLIT SPOON
Casing Size 4" PVC

Notes: WEATHER 70° + SUNNY EXCEPT RAIN FOR ≈15 MIN.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0.0'	0.0'-2.0' MW6-01	1.3'	4-8-5-7	TOP 6" TOP SOIL: DUSKY BROWN (5 YR 2/2) MED-FINE SILTY SAND W/ ≈ 25% GRAVEL. ORGANICS. (SM)
1.0'				LOWER 0.7' MODERATE YELLOWISH BROWN (10 YR 5/4) MEDIUM SAND WITH ≈ 35% GRAVEL, LITTLE TO NO FINES. (GP)
2.0'				Loose Compact
	2.0'-4.0' MW6-02	1.4'	4-4-9-13	MODERATE YELLOWISH BROWN (10 YR 5/4) MEDIUM SAND WITH ≈ 35% GRAVEL, LITTLE TO NO FINES. (GP)
3.0'				@ 3.5' - MULTI-COLORED POORLY SORTED FINE TO COARSE SAND AND SLAG. MOSTLY DARK BROWN → BLACK. ABUNDANT TAR FRAGMENTS. TRACE OF SILT
4.0'				LOOSE - MEDIUM COMPACT (SLAG)
	AMTL-034V AMTL-035V AMTL-036M CHEMICAL ANALYSIS 2:10 p.m.	1.2'	10-11-11-11	MULTI-COLORED POORLY SORTED FINE TO COARSE SAND AND SLAG. MOSTLY DARK BROWN → BLACK. ABUNDANT TAR FRAGMENTS. TRACE OF SILT. (SLAG)
6.0'				LOOSE - MEDIUM COMPACT
		H_2O AFTER WELL COMPLETION		~~SM~~ GP
7.0'				
8.0'				
	8.0'-10.0' MW6-03	1.3'	2-2-4-6	GRAVELLY SILTY SAND (5YR 3/2) FINE → COARSE SAND WITH APPRX. 20% GRAVEL (8.0'-9.0'). (GP) (9.0'-10.0') - DARK GRAY (N-3) SANDY CLAY WITH ≈ 20% GRAVEL AND ORGANICS PRESENT
9.0'				VERY LOOSE COMPACTION (GC)
10.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MØ-06
Page 2 of 2
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'				
11.0'				
12.0'				
13.0'		WET ON SPOON SEE H_2O THRU AUGER		
14.0'	14.0'-16.0' MØ6-04	24.0"	6-6-8-10	LIGHT OLIVE GRAY (5 Y 5/2) FINE-MED WELL SORTED SILTY SAND (ML) LOOSE COMPACTION
15.0'	14.0'-16.0' ATTERBURG LIMITS SIEVE ANALYSIS SPECIFIC GRAVITY	1.3'	2-2-1-2	SAME (ML)
16.0'				
17.0'				
18.0'				
19.0'				19.0' = T.D. OF H.S.A.
	19.0'-21.0' MØ6-05	~~2" 30 32~~ ~~21~~ 97 0.8'	22-30-32 -21	LIGHT OLIVE GRAY (5 Y 5/2) VERY FINE SILTY SAND WITH A TRACE OF CLAY. 1 ROCK FRAGMENT @ ~20.5'. (CL) VERY COMPACT
20.0'				
21.0'				
22.0'				
23.0'				
24.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MB-07
Page 1 of 3
Date Start 6/15/88
Date Complete 6/16/88

Client E.G. & G. Idaho, Inc.
Case No.
Project AMTL Watertown, MA.
Location Grass strip along fence, N.E. of Colemans House.
Contractor GZA Drilling, Inc.
Logged By Jeffrey W. Forther, Weston Geophysical
Drill Method Auger
Total Depth 39.0'
Hole Diameter 12 1/8"
Drilling Additives None
Static Water Level
Sampling Method Split Spoon
Casing Size 4" PVC
Notes

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0.0'	0.0'-2.0' MB7-01 Atterburg Limits Sieve Anal. Spec. Grav.	0.6'	~~2-3-3-4~~ No Recovery (Cobble) 2-3-2-3	Moderate brown (5 YR 4/4) silty sand w/ abundant organics and 20% gravel. Some coarse sand. (GM) - Top Soil (0.0'-0.4') - Fill (0.4'-0.6') Light brown (5 YR 5/6) poorly sorted fine to coarse silty sand w/ gravel (25%) and cobbles in spoils. Fill. Loose compaction (GM)
1.0'				
2.0'				
3.0'				
4.0'				
4.0'	4.0'-6.0' MB7-02 AMTL-053 V AMTL-054 V AMTL-055 M Time:	1.6'	25-34-41-44 3" OCA. Spoon	~~Dark yellowish~~ 97 97 Light brown (5 YR 5/6) poorly ~~Moderate brown (5 YR 4/4)~~ sorted fine → coarse silty sand w/ 2 40% gravel and cobbles. (4.0'-4.3') (GM) 4.3'-6.0': Moderate yellowish brown (10 YR 5/4) poorly sorted fine → coarse sand w/ gravel and 2 45% cobbles. ~~(Lose)~~ Little to no fines. ~~(Fill)~~ 97 97 (SP) Very compact
5.0'				
6.0'				
7.0'				
8.0'	8.0'-10.0' MB7-03	2.0'	24-46-42-71	Moderate yellowish brown (10 YR 5/4) poorly sorted fine → coarse sand w/ gravel and 2 45% cobbles. Little to no fines ~~(Fill)~~. 97 (SP)
9.0'				
10.0'				Very compact

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MØ-07
Page 2 of 3
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'				
11.0'				
12.0'				
13.0'				
14.0'	14.0'-16.0' MØ7-04	1.8'	26-40-26-16	MODERATE YELLOWISH BROWN (10 YR 5/4) POORLY SORTED FINE → COARSE SAND W/ GRAVEL AND ≈ 45% COBBLES. LITTLE TO NO FINES. ~~(FELL)~~ 97 "A PIECE OF CONCRETE W/ FORMED EDGES WAS FOUND IN MIDDLE OF SPOON. (SP) VERY COMPACT
15.0'				
16.0'				
17.0'				
18.0'				
19.0'	19.0'-21.0' MØ7-05		22-35-46-28	MODERATE YELLOWISH BROWN (10 YR 5/4) POORLY SORTED FINE → COARSE SAND W/ GRAVEL AND ≈ 40% COBBLES. LITTLE TO NO FINES. ~~(FELL)~~ 97 (SP) VERY COMPACT
20.0				
21.0'				
22.0'				
23.0'				
24.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MØ-07
Page 3 of 3
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
24.0'	24.0'-26.0' MØ7-06	2.0'	22-41-54-46	24.0'-24.7' – GRAYISH ORANGE (10 YR 7/4) WELL ~~SORTED~~ SORTED MILACEOUS MEDIUM SAND (SW) 24.7'-26.0' – MODERATE YELLOWISH BROWN (10 YR 5/4) POORLY SORTED FINE → COARSE SAND W/ GRAVEL AND ≈ 30% COBBLES. LITTLE TO NO FINES. (SP) VERY COMPACT
27.0'				
28.0'				
29.0'	29.0'-30.0' MØ7-07	1.6'	~~22-41-54~~ ~~46~~ 95	MODERATE YELLOWISH BROWN (10 YR 5/4) POORLY SORTED FINE → COARSE SAND W/ GRAVEL (25%) AND ≈ 25% ~~GRAVEL AND~~ COBBLES. TRACE OF SILT. (SP)
30.0'		29.6' WET ON SPOON	15-17-21 -16	
31.0'				VERY COMPACT
32.0'				
33.0'				
34.0'	34.0'-36.0' MØ7-08	1.4'	9-21-26 -36	MODERATE YELLOWISH BROWN (10 YR 5/4) POORLY SORTED FINE → COARSE SAND W/ GRAVEL (40%). NO COBBLES. TRACE OF SILT. (SP) VERY COMPACT
35.0'				
36.0'				
37.0'				
38.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MØ-08
Page 1 of 4
Date Start 6/16/88
Date Complete 6/17/88

Client E.G.&G. IDAHO, INC.
Case No.
Project AMTL WATERTOWN, MA.
Location MEDIAN STRIP E. OF BLDG. #37
Contractor GZA DRILLING INC.
Logged By JEFFREY W. FORTNER, JESTON GEOPHYSICAL CORP.
Drill Method AUGER
Total Depth 42.0'
Hole Diameter 12 1/8"
Drilling Additives NONE
Static Water Level
Sampling Method SPLIT SPOON
Casing Size 4" PVC
Notes

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0.0'	0.0' - 2.0' MB-01	1.3'	3-2-2-11	MODERATE BROWN (5 YR 4/4) SILTY SAND W/ABUNDANT ORGANICS AND 20% COARSE SAND AND GRAVEL. (GM) LOOSE COMPACTION
1.0'				
2.0'	AMTL-056 V AMTL-057 V AMTL-058 M TIME: 12:57 2.0' - 4.0'	1.1'	10-7-12-16	MODERATE YELLOWISH BROWN (10 YR 5/4) POORLY SORTED FINE → COARSE SAND W/ ≈ 40% GRAVEL AND 10% COBBLES. TRACE SILT. (FILL?) (SP) MEDIUM COMPACTION
3.0'				
4.0'	4.0' - 6.0' MØB-02 ATTERBURG LIMITS SIEVE ANALYSES SPECIFIC GRAVITY	0.7'	18-18-23-34	MODERATE YELLOWISH BROWN (10 YR 5/4) POORLY SORTED FINE → COARSE SAND W/ ≈ 30% GRAVEL AND 5% COBBLES. TRACE SILT. (FILL?) (SP) COMPACT
5.0'				
6.0'				
7.0'				
8.0'	8.0' - 10.0' MØB-03	1.5'	25-35-49-60	8.0' - 9.5': MODERATE YELLOWISH BROWN (10 YR 5/4) POORLY SORTED FINE → COARSE SAND W/ ≈ 20% COBBLES AND GRAVEL. LITTLE TO NO FINES. (SP) 9.5' - 10.0': MULTI COLORED POORLY SORTED FINE → COARSE SAND W/ ≈ 50% GRAVEL AND 5% COBBLES. LITTLE TO NO FINES. (SOME TILL) (GP) VERY COMPACT
9.0'				
10.0'				

Arthur D. Little, Inc.

SOIL BORING LOG

Boring No. MØ-08

Page 2 of 4

Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'				
11.0'				
12.0'				
13.0'				
14.0'	14.0'-16.0' MB-04	~~48-71-42-40~~ → 1.2'	48-71-42-40	MULTI COLORED POORLY SORTED FINE → COURSE SAND W/ APPROX. 40% GRAVEL AND 10% COBBLES. LITTLE TO NO FINES. (GP) VERY COMPACT
15.0'				
16.0'				
17.0'				
18.0'				
19.0'	19.0'-21.0' MB-05	1.3'	14-17-27 27	MULTI COLORED POORLY SORTED FINE → COARSE SAND W/ ≈ 25% GRAVEL, 5% COBBLES. TRACE SILT. (GP) COMPACT
20.0'				
21.0'				
22.0'				
23.0'				
24.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MØ-08
Page 3 of 4
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
821.0'				
25.0'	24.0'-26.0' MØB-06	1.6'	25-29-23 -22	24.0'-25.0': MODERATE YELLOWISH BROWN (10 YR 5/4) MEDIUM SAND w/ ≈ 10% GRAVEL. LITTLE TO NO FINES (SP) (SW) 25.0'-26.0': MULTI COLORED POORLY SORTED FINE → COARSE SAND w/ ± 20% GRAVEL AN 15% COBBLES VERY COMPACT (GP)
26.0'				~~GRAYISH ORANGE (10 YR 7/4) VERY WELL SORTED MEDIUM MICACEOUS SAND w/ LITTLE TO NO FINES.~~ QT
27.0'				
28.0'				
29.0'				
30.0'	29.0'-31.0' MØB-07	1.6'	10-22-22 -40	GRAYISH ORANGE (10 YR 7/4) VERY WELL SORTED MEDIUM MICACEOUS SAND w/ LITTLE TO NO FINES. (SW)
31.0'				COMPACT
32.0'				
33.0'		WET ON SPOON ▼		
34.0'				
35.0'	34.0'-36.0' MØB-08	1.5'	6-9-9-10	GRAYISH ORANGE (10 YR 7/4) VERY WELL SORTED MEDIUM MICACEOUS SAND w/ ~~LITTLE FINES~~ QT TRACE SILT. (SW)
36.0'				MEDIUM COMPACT
37.0'				
38.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MB-08
Page 4 of 4
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
38.0'				
39.0'	39.0'-41.0' MB-09	2.0'	12-19-22-31	39.0'-40.7': GRAYISH ORANGE (10YR 7/4) VERY WELL (SW) SORTED MEDIUM MICACEOUS SAND. LITTLE TO NO FINES.
40.0'				40.7'-41.0': VERY FINE, WELL SORTED, MODERATE YELLOWISH BROWN (10 YR 5/4) SAND. TRACE SILT. (MICACEOUS). (SW)
41.0'				COMPACT
42.0'				
43.0'				
44.0'				
45.0'				
46.0'				
47.0'				
48.0'				
49.0'				
50.0'				
51.0'				
52.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MW-09
Page 1 of 3
Date Start 5/25/88
Date Complete

Client EG&G IDAHO, INC. | Case No.

Project AMTL WATERTOWN, MA. | Location NORTH OF NORTH EAST CORNER OF BLDG. 43 BY FENCE NEAR ROAD

Contractor GZA DRILLING | Logged By JEFFREY W. FORBNER (WESTON GEOPHYSICS)

Drill Method AUGER | Total Depth @ 25.0' | Hole Diameter 12 1/8"

Drilling Additives NONE. | Static Water Level 14.48'

Sampling Method SPLIT SPOON ~~+ SHELBY TUBE~~ 97 | Casing Size 4" PVC

Notes: WEATHER - OVERCAST, PROBABLE SHOWERS ON & OFF.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0	0.0'-2.0'	1.5'	~~11~~ 99	TOP 5" DUSKY BROWN (5YR 2/2) SILTY SAND (SM) WITH ≈ 20% GRAVEL, AND ORGANICS. (TOPSOIL)
1.0'	MW9-01		1-5-7-15	LOWER 8" MODERATE YELLOWISH BROWN (10YR 5/4) MEDIUM SAND WITH ≈ 30% GRAVEL (FILL) (SW)
2.0'				MEDIUM COMPACTION
3.0'				
4.0'	4.0'-6.0'	0.8'	4-8-8-10	DARK YELLOWISH BROWN (10 YR 4/2) MED-FINE SAND WITH 15% GRAVEL AND 15% SILT. APPEARS TO BE FILL. (SW)
5.0'	MW9-02			
6.0'				MEDIUM COMPACTION
7.0'	6.0'-8.0' MW9-03	0.4'	8-18-23-17	DUSKY BROWN (5 YR 2/2) SANDY SILT INTERBEDDED WITH WELL SORTED MEDIUM DARK YELLOWISH ORANGE (10 YR 6/5) SAND. (SM)
8.0'				COMPACT
9.0'	8.0'-10.0' AMTL-018 AMTL-019 AMTL-020 CHEM. ANALYSES: IDEOSAM.	1.65'	6-5-5-6	DUSKY BROWN (5 YR 2/2) SILTY SAND WITH SOME (10%) GRAVEL FROM 8.0'-9.8'. 9.0'-10.0' MODERATE YELLOWISH BROWN (10 YR 5/4) SANDY SILT WITH 15% GRAVEL AND ORGANICS. (NATURAL) (SM)
10.0'				LOOSE COMPACTION

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MW-09
Page 2 of 3
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'				
11.0'				
12.0'				
13.0'				
14.0'				
	14.0'-16.0' MDG-04	1.25' WET SM SPOON	3-20-35 -28	DUSKY BROWN (10 YR 2/2) FINE-MED. SANDY SILT WITH ≈ 20% GRAVEL (@ 1410'-15.6'). (GC) FROM 15.0'-16.0' YELLOWISH GRAY (5 Y 7/2) POORLY SORTED FINE-COARSE SAND WITH A TRACE OF SILT AND ≈ 30% GRAVEL. (SP) COMPACT
15.0'				
16.0'				
17.0'				
18.0'				
19.0'				
	19.0'-21.0' MDG-5		21 25-35	DUSKY BROWN (10 YR 2/2) FINE-MED. SILTY SAND FROM 19.0'-20.0' 15% GRAVEL. (SP) 20.0'-21.0' YELLOWISH GRAY (5Y 7/2) WELL SORTED MED-COARSE CALCAREOUS SAND WITH FINES ≈ GRADING INTO VERY FINE SILTY SAND W/DEPTH. COMPACT (SW)
20.0'				
21.0'				
	21.0'-28.0' GEO. TECH. ATTERBERG LIMITS SIEVE ANAL. SPEC. GRAV.	2.0'	12-17-12 -22	LIGHT OLIVE GRAY (5 Y 5/2) MED-COARSE SAND, VERY WELL SORTED GRADING INTO A FINE SILTY SAND (VERY WELL SORTED) WITH DEPTH. (ML) MEDIUM COMPACT - COMPACT HNU = 0.7 ppm
22.0'				
23.0'				
24.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MB-09
Page 3 of 3
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
24.0'				
				T.D. OF H.S.A.
25.0'	25.0'-27.0'		20-30-18-19	LIGHT OLIVE GRAY (5 Y 5/2) MED-VERY FINE SILTY SAND GRADING WITH DEPTH TO A SANDY SILT. (ML)
26.0'	MB9-06			
27.0				COMPACT
28.0'				
29.0'				
30.0'				
31.0'				
32.0'				
33.0'				
34.0'				
35.0'				
36.0'				
37.0'				
38.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. M10-10
Page 1 of 2
Date Start 5/31/88
Date Complete 6/1/88

Client E.G. + G. IDAHO, INC. | Case No
Project AMTL WATERTOWN, MA. | Location N.W. CORNER OF COMPLEX; N.W. OF BLDG. 246.
Contractor GZA DRILLING | Logged By JEFF FORTNER (WESTON GEOPHYSICAL)
Drill Method AUGER | Total Depth 19.0' | Hole Diameter 12 1/8"
Drilling Additives NONE | Static Water Level
Sampling Method SPLIT SPOON | Casing Size 4" PVC
Notes: 80° AND SUNNY ON 5/31/88

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0.0'	0.0'-2.0' M10-01	0.9'	2-3-3-4	DARK YELLOWISH BROWN (10 YR 4/2) SILTY SAND WITH ORGANICS (TOP SOIL 1ST 5"). (SM)
1.0'				MODERATE BROWN (5 YR 4/4) SANDY SILT WITH ANGULAR GRAVEL ≈ 15% AND PIECES OF CEMENT (FILL). (SM) LOOSE COMPACTION HNu = 0.6 ppm
2.0'	2.0'-4.0' AMTL-037M AMTL-038V AMTL-039V CHEM. ANALYSES TIME: 10:45	1.1'	13-8-5 -5	MODERATE BROWN (5 YR 4/4) SANDY SILT WITH ANGULAR GRAVEL ≈ 25%. ALSO SOME CEMENT FILL. (SM)
3.0'				
4.0'				MEDIUM COMPACT
	4.0'-6.0' M10-02	0.7'	7-4-12 -10	MODERATE BROWN (5 YR 3/4) VERY FINE SILTY SAND WITH ≈ 25% COARSE SAND. (SM)
5.0'				
6.0'				MEDIUM COMPACT HNu = 0.6 ppm
7.0'	M10-02 1/2 LITHOLOGIC CHANGE.	SAMPLE FROM SPOILS.		* AT ≈ 7.5' WE BEGAN GETTING A MODERATE YELLOWISH BROWN (10 YR 5/4) VERY WELL SORTED MEDIUM SAND, IN THE DRILL CUTTINGS. (SW)
8.0'				
	8.0'-10.0' M10-03	2.0' WET ON SPOON 2.9'	5-8-10 -8	DUSKY YELLOW (5Y 6/4) WELL SORTED FINE-MED. MICACEOUS SAND W/ LITTLE TO NO GRAVEL. (SW)
9.0'				
10.0'				MEDIUM COMPACT HNu = 0.6 ppm

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MB-10
Page 2 of 2
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'				
11.0'				
12.0'				
13.0'				* At 13.0' AUGERS BEGAN BUCKING ON COBBLES.
14.0'	14.0'-16.0' MID-04	2.0'	7-12-12 -13	LIGHT OLIVE GRAY (5Y 5/2) FINE SILTY SAND GRADING W/ DEPTH TO AN OLIVE GRAY (5Y 3/2) CLAYEY SILT. ALL IS MICACEOUS. 30% FINE SAND. SW → SL CL 97
16.0'				MEDIUM COMPACT HNu = 0.6ppm
17.0'				
18.0'	17.0'-19.0' ATTERBURG LIMITS SIEVE ANAL. SPEC. GRAV.	2.0'	7-9-10 -12	OLIVE GRAY (5Y 3/2) CLAYEY SILT W/ 20% FINE SAND. MICACEOUS. CL MEDIUM COMPACT
19.0'				
20.0'	19.0'-21.0' MID-05	2.0'	4-6-7 -8	OLIVE GRAY (5Y 3/2) SILTY CLAY WITH LITTLE ~~TO~~ FINE SAND. 97 CL MEDIUM COMPACT
21.0'				
22.0'				
23.0'				
24.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MB-11
Page 1 of 2
Date Start 6/14/88
Date Complete 6/14/88

Client E.G. & G. Idaho, Inc.
Case No.
Project AMTL Watertown, MA.
Location On grass terrace ≈ ½ way between MB-05 and MB-06
Contractor GZA Drilling, Inc.
Logged By Jeffrey W. Fortner, Weston Geophysical Corp.
Drill Method Auger
Total Depth 16.0'
Hole Diameter 12 1/8"
Drilling Additives None
Static Water Level 6.0'
Sampling Method Split Spoon
Casing Size 4" PVC
Notes

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0.0'	0.0'-2.0' MB11-01	0.9'	3-3-2-1	0.0'-0.4' - Top soil, silty organic dusky brown (5YR 2/2) sand. (SM) 0.4'-2.0' - Dusky brown (5 YR 2/2) poorly sorted silty sand (fine-med.) w/ brick fragments and 30% gravel. Loose compaction. 99 (SM) (GM)
2.0'				
3.0'	Atterburg Limits, Sieve Analysis, Spec. Grav.	0.7'	3-4-6-7	Dusky brown (5 YR 2/2) poorly sorted silty sand (fine-medium) w/ cobbles and approx. 25% gravel. (FILL) (SM) 99 (GM) Loose compaction
4.0'				
5.0'	4.0'-6.0' MB11-02	1.1'	8-7-5-6	Dusky brown (5 YR 2/2) poorly sorted silty sand (fine-med) w/ cobbles and ≈ 30% gravel (fill) (SM) 99 (GM) Medium compaction
6.0'				
7.0'	6.0'-8.0' AMTL-050 ✓ AMTL-051 ✓ AMTL-052 ✓ Time: 10:40	Wet on spoon ▽ 1.8'	10-8-8-9	Dusky brown (5 YR 2/2) poorly sorted silty sand (fine-medium) w/ cobbles and approx. 30% gravel (6.0'-7.0') (GM) 7.0'-8.0' Moderate yellowish brown (5 YR 5/4) fine silty sand. (SM) Medium compaction
8.0'				
9.0'	8.0'-10.0' MB11-03	2.0'	~~3-6-6-5~~ No sample 5-8-8-9	8.0'-8.3' - Brownish black (5 YR 2/1) fine silty sand with shell fragments. (SM) 8.3'-8.8' - Olive gray (5 Y 4/1) highly vesicus saturated silty sand (SM) 8.8-9.1' - Brownish black (5 YR 2/1) silty med sand w/ some course sand. (SM) 9.1-10.0' Moderate brown (5 YR 3/4) well sorted, miscellous fine sand. (SM) Medium compaction
10.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No.
Page 2 of 2
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'				
11.0'				
12.0'				
13.0'				
14.0'				
	14.0' - 16.0' M11-04	1.8'	3-5-7 -13	MODERATE BROWN (5 YR 3/4) WELL SORTED VERY FINE SILTY SAND w/ RANDOMLY LOCATED BLACK SPLOTCHES (POSSIBLY ORGANIC) WHICH OCCUPY ≈ 5% OF THE SAMPLE. (SM)
15.0'				
16.0'				MEDIUM COMPACTION
17.0'				
18.0'				
19.0'				
20.0'				
21.0'				
22.0'				
23.0'				
24.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MW-12
Page 1 of 4
Date Start 5/23/88
Date Complete 5/24/88

Client EG&G, IDAHO, INC.
Case No. 61453
Project AMTL, WATERTOWN
Location EAST END OF TRAFFIC ISLAND BETWEEN BUILDING 37 AND 131
Contractor GZA DRILLING
Logged By RICHARD PENDLETON, WESTON GEO.
Drill Method AUGER
Total Depth 41.0'
Hole Diameter 12 1/8"
Drilling Additives NONE
Static Water Level 30.5'
Sampling Method SPLIT SPOON (24")
Casing Size —
Notes SEE NOTE ON BORING LOG GENERAL DATA SHEET.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0		1.4'	1-1-5-6	0-0.8 Olive (5Y 3/2) & black fn-med sand and some g gravel (topsoil) dry, very loose moist (SW)
1.0	0.0-2.0'			0.8-1.3 Light brown (5YR 5/6) silty fn. sand some g gravel, damp loose (SM)
	MW-12-01			1.3-1.4 Light brown (5YR 5/6) med-crs sand some gravel medium compact (SW)
2.0				HNU 1.3
3.0				
4.0		1.6 (RMP) 1.3'	12-29-21-21	0-1.3 (0.6) Dusky yellow (5Y 6/4) med-crs sand and some gravel, dry (SP)
5.0	4.0-6.0 AMTL-12 AMTL-13 AMTL-14 ~~MW-12-02~~			0.6-1.3 Dusky yellow (5Y 6/4) fn-crs sand, dry very compact throughout (SW)
6.0				HNU 1.5
		1.4'	30-46 53-60	0-0.7 Dusky yellow (5Y 6/4) med sand damp (SW)
7.0	6.0-8.0			0.7-1.4' Dusky yellow (5Y 6/4) med. sand and medium bluish gray (5B 5/1) gravel (SW) very compact throughout, damp
	MW-12-02			HNU 1.6
8.0				7.0' ROUGH AUGERING BROWN SAND, GRAVEL, COBBLES FROM AUGER
9.0				
10.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MW-12
Page 2 of 4
Case No. 61457

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'	10.0-12.0' MW-12-03	2.0'	7-12 15-15	0-1.5 ~~loam~~ Variable colors (whites, blues, reds, browns) urs sand and gravel, moist, (SW) 1.5-2.0 Dusky yellow (5Y 6/4) fn-med sand, some silt medium compact throughout (SM) HNU 0.7
12.0'	3 samples taken. No geologic sample. 12.0-14.0' Atterberg limits Specific gravity Sieve Analysis	1.2'	7-12 15-20	0-0.6 Dusky yellow (5Y 6/4) fn-med sand, some silt, moist (SM) 0.6-1.2' Dusky yellow (5Y 6/4) med. sand and variable colored gravels (SW) medium compact HNU 0.5
14.0	14.0-16.0' MW-12-04	1.3'	5-10 14-16	Dusky yellow (5Y 6/4) - yellowish gray (5Y 7/2) fn.-med sand trace silt, moist (SM) loose - medium compact HNU 0.6
16.0				
17.0				
18.0				
19.0				
20.0	19'-21.0' MW-12-05	1.7'	22-31 24-38	0-0.2' light olive brown (5Y 5/6) med sand some gravel dry (SW) 0.2-0.4 dusky yellow (5Y 6/4) silty fn. sand dry (SM) 0.4-0.5 olive gray (5Y 3/2), silt some fn. sand (SML) 0.5-1.5 fn. sand well sorted some silt dusky yellow (SM) 1.5-1.7 dusky yellow clayey silt with some peat organics dry Compact - very compact (ML) HNU=0.7
21.0				
22.0				
23.0				
24.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MW-12
Page 3 of 4
Case No. 61453

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
824.0	24.0 - 26.0	2.0'	10-9 12-17	1.5' Dusky yellow fn-med sand, (SM)
25.0				1.5-2.0 Dusk yellow fn-med sand ~~with~~ same variable colored gravel faint layering throughout (SW)
26.0	MW-12-06			
				27.0' moist fn-med sand from auger
27.0				
28.0				
29.0	29.0-31.0'	1.6'	11-13 13-17	Dusky yellow fn-med sand, well sorted wet at 30' (SM)
30.0	MW-12-07			
31.0				medium compact - compact
32				
33				
34	34.0-36.0	0.6	20-24 22-23	light olive brown (5Y5/6) mix of gravel, clayey silt, and fn. sand, wet (SW)
35.	MW-12-08			running sand from spoon
36.0				
37.0				
38.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MØ-13
Page 2 of 2
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0'				
11.0'				
12.0'		WET ON ~~GROUND~~ ROD @ 12'		
13.0'				
14.0'	14.0'-16.0' M13-04	1.37'	18-20-15 -15	VARIOUS INTERSPERSED COLORS (FILL). POORLY SORTED FINE → COARSE SAND AND ANGULAR GRAVEL. ≈ 5% SILT. (GP) COMPACT
15.0'				
16.0'				
17.0'				
18.0'				
19.0'				
20.0'	19.0'-21.0' M13-05 ATTERBURG LIMITS SPECIFIC GRAV. SIEVE ANALYS.	2.0'	6-11-28 -36	19.0'-20.0': OLIVE GRAY (5Y 4/1) WELL SORTED FINE SAND (MICACEOUS) W/ A TRACE OF SILT. SEDIMENT GRADES COARSER W/ DEPTH TO A GRAVELLY SAND @ 20.0'. (MH) 20.0'-21.0': LIGHT OLIVE BROWN (5Y 5/6) FINE SANDY SILT, W/ TRACE OF CLAY. (MH) COMPACT
21.0'				
22.0'	H.S.A. DEPTH			
23.0'				
24.0'				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. M4-14
Page 1 of 3
Date Start 5/18/88
Date Complete ~~5/18/88~~ 5/19/88

Client E.G.&G. IDAHO, INC.
Case No.
Project AMTL WATERTOWN, MA.
Location W.SW. CORNER BLDG. 311
Contractor GZA DRILLING
Logged By JEFFREY W. FORTNER (WESTON GEOPHYSICAL)
Drill Method AUGER
Total Depth 29.0'
Hole Diameter 12 1/4"
Drilling Additives NONE
Static Water Level 16.32'
Sampling Method SPLIT SPOON AND SCHELBY TUBE
Casing Size 4" PVC
Notes: RAINEY WEATHER

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
0	0.0'-2.0' M14-01	1.5'	2-6-9-13	TOP 6" (TOP SOIL): MODERATE BROWN ~~POORLY~~ FINE SILTY SAND WITH ORGANICS, <1% GRAVEL - (OL)
				DARK YELLOWISH BROWN FINE TO COARSE SAND (POORLY SORTED) WITH ≈ 40% ANGULAR GRAVEL. (FILL) (SW) MEDIUM COMPACT HNu = 0.6 ppm
2.6'				
3.0'				
4.0'	4.0'-6.0' M14-02	1.1'	3-4-4-11	TOP 6" MODERATE BROWN, POORLY SORTED, MED-BROWN SAND WITH ≈ 20% SILT AND 20% SMALL GRAVEL, COBBLES IN DRILL SPOILS. (FILL) (SW)
5.0'				LOWER .6' MODERATE YELLOWISH BROWN FINE SILTY SAND WITH ≈ 30% GRAVEL (ANGULAR) (FILL) (GM) HNu = 0.6 ppm LOOSE - MEDIUM COMPACT
6.0'				
7.0'	6.0'-8.0' M-006 M-007 M-008 CHEM. ANALYSES.	1.0'	20-25-28-27	GRAYISH ORANGE MED-COARSE SAND, ≈ 40% GRAVEL, COBBLES ABUNDANT IN DRILL SPOILS, AND ONE PRESENT IN SPOON ORAPELE ALLUVIUM. FOR PLUG RECOVERY. VOA'S FINE. METALS ONLY 2/3 OF JAR. (GP) COMPACT
8.0'				
9.0'	8.0'-10.0' M14-03	1.4' WET ON SPOON (FROM PERCHED TABLE)	17-9-7-11	TOP 9" DARK YELLOWISH BROWN MED-COARSE SAND <1% SILT, 10% GRAVEL. (SW)
10.0'				BOTTOM 10" LIGHT OLIVE BROWN CLAYEY SILT GRADING TO A VERY FINE SAND (WELL SORTED). HNu = 0.6 ppm LOOSE - MEDIUM COMPACT

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MB-14
Page 2 of 3
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
10.0			97 PW	
11.0				
12.0				
13.0				
14.0				
	14.0'-16.0' M14-04	24"	2-6-8-14	LIGHT OLIVE BROWN INTERBEDDED CLAYEY SILT AND SILTY CLAY. (DRY) OL HNu = 0.0 ppm LOOSE - MEDIUM COMPACT
15.0				
16.0				
	16.0'-18.0' M14-SHELBY TUBE.	24"	PUSHED	LIGHT OLIVE BROWN DRY CLAY ON BOTTOM OF SCHELBY TUBE WHICH HELPED IN MAKING THE DECISION TO CONTINUE DRILLING OL
17.0				
18.0				
19.0				
	19.0'-20.0' M14-05	24"	4-6-7-11	LIGHT OLIVE BROWN INTERBEDDED CLAYEY SILT AND SILTY CLAY, WITH ORGANICS IN THE SILTY CLAY. (DRY) - SOME H2O IN BOTTOM OF HOLE OL LOOSE COMPACT
20.0				
21.0				
22.0				
23.0				
24.0				

Arthur D. Little, Inc.
SOIL BORING LOG

Boring No. MØ-14
Page 3 of 3
Case No.

DEPTH (BELOW GRADE)	SAMPLE INTERVAL	RECOVERY	BLOWS PER 6"	GEOLOGIC DESCRIPTION
24.0'				
	24.0'-26.0' M14-06	24"	4-5-7-13	LIGHT OLIVE GRAY CLAYEY SILT W/ A TRACE OF FINE SAND. AT ≈ 25.0' A VERY WET FINE SILTY SAND WAS ENCOUNTERED IN SPOON TO 26.0'. LOOSE - MEDIUM COMPACT (ML)
26.0'				
27.0'				
28.0'				
29.0'				
	29.0'-31.0' M14-07	24"	3-5-8-10	LIGHT OLIVE GRAY INTERBEDDED SILTY CLAY AND FINE SANDY SILT, SOME ORANGISH ORGANICS IN CLAY. SAMPLE WAS RELATIVELY DRY. (ML) LOOSE - MEDIUM COMPACT
30.0'				
31.0'				
32.0'				
33.0'				
34.0'				
35.0'				
36.0'				
37.0'				
38.0'				

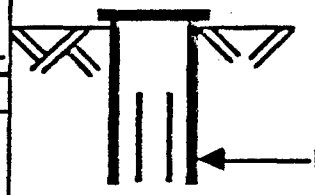
APPENDIX B

Well Diagrams

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. C-01
Page 1 of 2
Date Installed 6/15/88 GROUTED
Client EG&G IDAHO INC.
Case No.
Project AMTL, WATERTOWN
Location SW CORNER BUILDING 311
Contractor GZA DRILLING
Supervised By RICHARD PENDLETON
Drill Method AUGER CASING, 1 SPOON ROCK CORE.
Total Depth 78.2'
Hole Diameter 12¼" AT SURFACE TO 4" TO 78.2'
Grout Method CEMENT
Development Method —
SEE FIELD NOTES AND DIAGRAM BELOW
Measuring Point Elevation
Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
		0	
SANDY FILL	C1-01		LOCAL FILL
	C1-02	5.0	
CLAYS, SILTS, SANDS	C1-03	10.0	CEMENT
	AMTL 508 THRU AMTL 514		
	C1-04	15.0	
	C1-05	20.0	
	C1-SHELBY-1	25.0	
FINE SAND	C1-06		
	C1-07	30.0	
	C1-08	35.0	
INTERBEDDED FINE SAND AND CLAY	C1-09	40.0	
	C1-10, GEOTECH 1 THRU 3	45.0	
		50.0	



Elevation of Manhole Well Riser —
Protective Casing Type/Diameter —
Protective Casing Interval —
Type of Surface Seal: LOCAL FILL (TOPSOIL)
Sealed Interval: 0.0 - 5.0'
Well Casing Type/Diameter —
Cased Interval —
Type of Grout: ~~SCHEDULE~~ CEMENT
Grouted Interval: 5.0 - 78.2'
Type of Seal —
Sealed Interval —
Type of Pack —
Packed Interval —
Type of Screen —
Screen Size —
Screened Interval —
Depth of Hole: 78.2'

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. C-01
Page 2 of 2
Date Installed 6/15/88 GROUTED
Case No.

Client EG&G IDAHO INC

Project AMTL, WATERTOWN
Location SW CORNER BUILDING 311

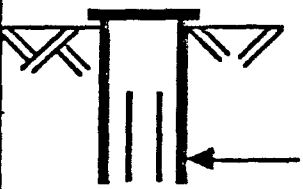
Contractor GZA DRILLING
Supervised By RICHARD PENDLETON

Drill Method AUGER, SPUN CASING, ROCK CORE
Total Depth 78.2'
Hole Diameter 4" TO 12 1/4"

Grout Method CEMENT
Development Method —

Measuring Point Elevation
Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
		50.0'	
INTERBEDDED FINE SAND AND CLAY	C1-11		
BOULDERY TILL	C1-RC-1	55.0'	
	C1-RC-2	60.0'	
MED. GRAY MASSIVE ARGILLITE	C1-RC-3		CEMENT
	C1-RC-4		
	C1-RC-5	65.0'	
	C1-RC-6	70.0'	
	C1-RC-7		
	C1-RC-8	75.0'	
	END OF BORING 78.2'	80.0'	
		85.0'	
		90.0'	
		95.0'	
		100.0'	



Elevation of Manhole
Well Riser
Protective Casing Type/Diameter
Protective Casing Interval
Type of Surface Seal
Sealed Interval
Well Casing Type/Diameter
Cased Interval
Type of Grout
Grouted Interval
Type of Seal
Sealed Interval
Type of Pack
Packed Interval
Type of Screen
Screen Size
Screened Interval
Depth of Hole

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. C-2
Page 1 of 1
Date Installed 5/27/88
Case No.

Client E.G. & G. IDAHO, INC.

Project AMTL WATERTOWN, MA.
Location S. OF BLDG. # 37, N.W. OF BLDG. # 131 @ EAST END OF TRAFFIC ISLAND

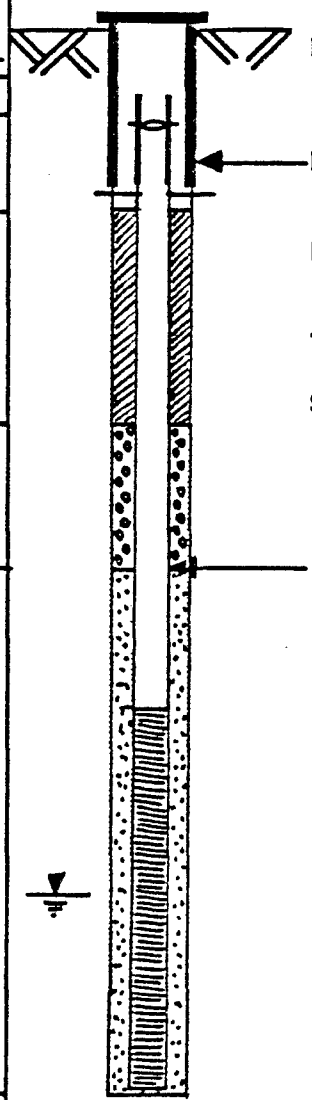
Contractor G.Z.A. DRILLING, INC.
Supervised By RICHARD PENDLETON WESTON GEOPHYSICAL CORP.

Drill Method AUGER
Total Depth 39.6'
Hole Diameter 12 1/8"

Grout Method USED TREMIE PIPE WITH BENTONITE CEMENT
Development Method PUMP (SUBMERSIBLE)

Measuring Point Elevation
Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
TOP SOIL		0.0'	
FILL	C2-01		CEMENT
	AMTL-16, 19, 22, 24, 25		
	C2-02	5.0'	
MED. → COARSE SAND W/ GRAVEL	AMTL-26→33		GROUT
	AMTL-26→32	10.0'	
	C2-03		
MEDIUM SAND	C2-04	15.0'	BENTONITE PELLETS
	C2-05	20.0'	QUARTZ SAND
INTERBEDDED FINE SAND AND SILT W/ TRACE OF CLAY	C2-06 1 THRU 4	25.0'	
	C2-VOC 1 THRU 7		
	C2-07 1 THRU 3 AMTL) 501→507	30.0'	
MED. → COARSE SAND		35.0'	
?		40.0'	
		45.0'	
		50.0'	



Elevation of Manhole
Well Riser

Protective Casing Type/Diameter 6"x4" STEEL W/LOCK CAP

Protective Casing Interval -0.3' → -4.3'

Type of Surface Seal 8 CEMENT BAGS
Sealed Interval 0.0' → -5.1'

Well Casing Type/Diameter 4" PVC
Cased Interval -0.4' → -24.4'

Type of Grout 50/50 CEMENT/BENTONITE
Grouted Interval -5.1' → -14.3'

Type of Seal BENTONITE 5"/3 PELLETS BUCKETS
Sealed Interval -14.3' → -19.3'

Type of Pack 22 QUARTZ SAND BAGS
Packed Interval -19.3' → -39.6'

Type of Screen 4" PVC
Screen Size .010 SLOT

Screened Interval -24.4' → -39.4'
Depth of Hole -39.6'

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. C-3
Page 1 of 1
Date Installed 6/17/88
Case No.

Client EG&G IDAHO INC.

Project AMTL, WATERTOWN

Location SE CORNER AMTL, W. OF SE. GATE, 20' SE OF MW-6

Contractor GZA DRILLING

Supervised By RICHARD PENDLETON

Drill Method AUGER

Total Depth 37.5'HSA 39.5'SS

Hole Diameter 9 1/2"

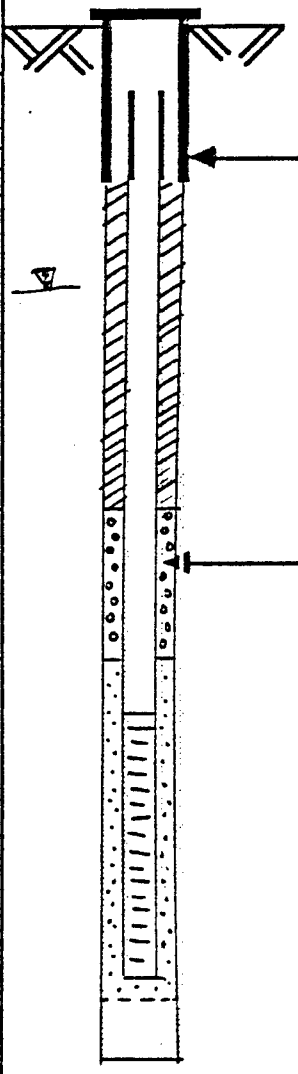
Grout Method BENTONITE CEMENT

Development Method

Measuring Point Elevation

Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
TOPSOIL	C3-01, C3-01A	0	CEMENT SAND BENTONITE SAND
FILL	C3-02, C3-02A	5.0	GROUT
	AMTL-530 THRU AMTL-534		
PEAT	C3-03	10.0	
	C3-SHELBY #1		
	C3-04	15.0	
INTERBEDDED SILTY SAND AND CLAY	C3-05	20.0	BENTONITE
	C3-06	25.0	
SAND AND GRAVAL	C3-07 GEOTECH THRU	30.0	SAND
	position questionable		
TILL	C3-08	35.0	HEAVE
	C3-09	40.0	
		45.0	
		50.0	



Elevation of Manhole / Well Riser: -0.46

Protective Casing Type/Diameter: STEEL / 12 1/8 / LOCK CAP

Protective Casing Interval: 0.14' - 4.0'

Type of Surface Seal: BENTONITE : CEMENT

Sealed Interval: 0.0' - 4.5'

Well Casing Type/Diameter: PVC / 4"

Cased Interval: 0.46 - 24.6'

Type of Grout: BENTONITE CEMENT

Grouted Interval: 4.5' - 17.4'

Type of Seal: BENTONITE - 2 1/2 BUCK.

Sealed Interval: 17.4 - 22.5'

Type of Pack: SILICA SAND 5 BAGS

Packed Interval: 22.5' - 35.0'

Type of Screen: PVC

Screen Size: 0.010" SLOT

Screened Interval: 24.6' - 34.6'

Depth of Hole: 37.5'

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. MW-01
Page 1 of 1
Date Installed 5/18/88
Case No.

Client E.G. & G. IDAHO INC.

Project AMTL WATERTOWN, MA.
Location S.W. OF BLDG. #39

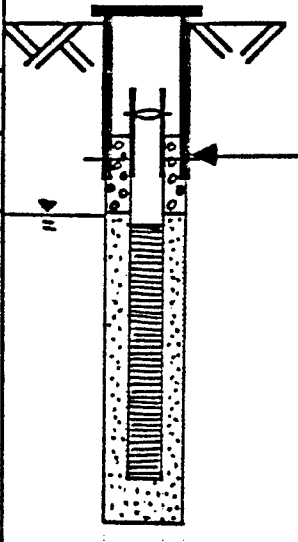
Contractor G.Z.A. DRILLING, INC.
Supervised By RICHARD PENDLETON, WESTON GEOPHYSICAL CORP.

Drill Method AUGER
Total Depth 17.7'
Hole Diameter 12 1/8"

Grout Method BENTONITE CEMENT w/ TREMIE PIPE
Development Method PUMP

Measuring Point Elevation
Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
		0.0'	CEMENT
FILL: SILTY SAND SOME GRAVEL	MO1-01		
	AMTL-001, 002		BENTONITE PELLETS
	MO2-02	5.0'	
MED-CRS SAND			
	MO1-03	10.0'	QUARTZ SAND
SILTY FN. SAND & CLAYEY SILT	AMTL-003, 004, 005 SB-1		
	MO1-04	15.0'	
END OF BORING		20.0'	
		25.0'	
		30.0'	
		35.0'	
		40.0'	
		45.0'	
		50.0'	



Elevation of Manhole / Well Riser: ____

Protective Casing Type/Diameter: 6 1/4" STEEL w/ LOCK CAP

Protective Casing Interval: -2" → -3'2"

Type of Surface Seal: CEMENT — 9 BAGS
Sealed Interval: 0.0' → -1.6'

Well Casing Type/Diameter: 4" PVC
Cased Interval: -5" → -6.5'

Type of Grout: NONE
Grouted Interval: NONE

Type of Seal: BENTONITE PELLETS — 4 BUCKETS
Sealed Interval: -1.6' → -5.1'

Type of Pack: QUARTZ SAND — 15 BAGS
Packed Interval: -5.1' → -17.5'

Type of Screen: 4" PVC
Screen Size: .010 SLOT

Screened Interval: -6.5' → -16.5'
Depth of Hole: -17.7'

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. MW-02
Page 1 of 1
Date Installed 5/23/88
Case No.

Client E. G. & G. IDAHO, INC.

Project AMTL WATERTOWN, MA.

Location ON GRASS, ALONG FENCE, SOUTH CENTER OF BLDG. 292 AND WEST OF BLDG. 97

Contractor G.Z.A. DRILLING

Supervised By JEFFREY W. FORTNER, WESTON GEOPHYSICAL CORP.

Drill Method AUGER

Total Depth 16.27'

Hole Diameter 12 1/8"

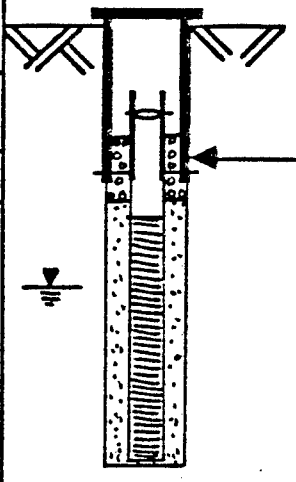
Grout Method NONE

Development Method PUMP

Measuring Point Elevation

Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
TOP SOIL	MW2-01	0.0'	CEMENT
FILL	AMTL-09,10,11		BENTONITE PELLETS
	MW2-02	5.0'	
	MW2-03	10.0'	QUARTZ SAND
SILTY CLAY W/ TRACE OF FINE SAND	MW2-04	15.0'	
	SH-3		
BOTTOM OF SHELBY TUBE		20.0'	
		25.0'	
		30.0'	
		35.0'	
		40.0'	
		45.0'	
		50.0'	



Elevation of Manhole / Well Riser: ____

Protective Casing Type/Diameter: 6"x4" STEEL W/LOCK CAP

Protective Casing Interval: -2" → -3'11"

Type of Surface Seal: CEMENT — 8 BAGS

Sealed Interval: 0.0' → -2.5'

Well Casing Type/Diameter: 4" PVC

Cased Interval: -5" → -6.0'

Type of Grout: NONE

Grouted Interval: NONE

Type of Seal: BENTONITE PELLETS — 3 BUCKETS

Sealed Interval: -2.5' → 5.0'

Type of Pack: QUARTZ SAND — 11 BAGS

Packed Interval: -5.0' → -16.27'

Type of Screen: 4" PVC

Screen Size: 10 SLOT

Screened Interval: -6.0' → -16.0'

Depth of Hole: -16.27'

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. MW-3
Page 1 of 1
Date Installed 6/13/88
Case No.

Client EG & G IDAHO, INC.

Project AMTL, WATERTOWN | Location SOUTH OF BUILD. 36

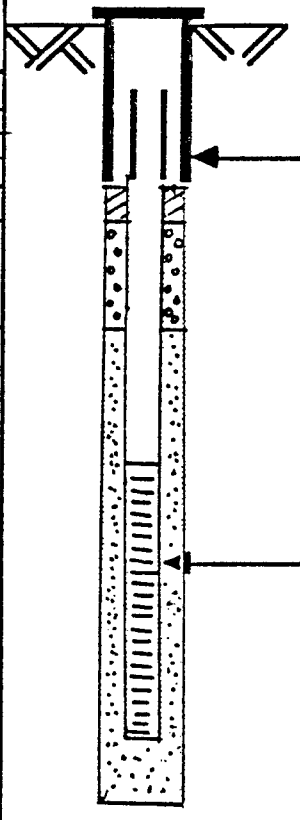
Contractor GZA DRILLING | Supervised By RICHARD PENDLETON (WGC)

Drill Method AUGER | Total Depth 27.5', HSA 29.5' SS | Hole Diameter 12 1/8"

Grout Method BENTONITE CEMENT | Development Method

Measuring Point Elevation | Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
CONCRETE			
FILL	M3-01	0.0'	CEMENT
			BENTONITE
	M3-02 M3-GT-1 TO 3	5.0'	SAND
SAND AND GRAVAL			GROUT
			BENTONITE PELLETS
	M3-03	10.0'	
FILL?			
	M3-04 AMTL 518 → 524	15.0'	SILICA SAND
INTERBEDDED SILTY FN. SAND AND SILTY CLAY	M3-05 AMTL 525 → 529	20.0'	
	M3-06	25.0'	
END OF BORING 27.5' SPLIT SPOON AT 29.5'	M3-07	30.0'	
		35.0'	
		40.0'	
		45.0'	
		50.0'	



Elevation of Manhole / Well Riser: -0.49
Protective Casing Type/Diameter: STEEL / 12 1/8"
Protective Casing Interval: 0.19 - 3.5'
Type of Surface Seal: CEMENT/BENTONITE
Sealed Interval: 0.0' - 4.1'
Well Casing Type/Diameter: PVC sched 40 / 4"
Cased Interval: 0.49 - 15.9
Type of Grout: Bentonite Cement
Grouted Interval: 4.1' - 6.3'
Type of Seal: BENTONITE
Sealed Interval: 6.3' - 11.2'
Type of Pack: SILICA SAND
Packed Interval: 11.2' - 27.5'
Type of Screen: 4" PVC
Screen Size: 0.010" SLOT
Screened Interval: 15.9' - 25.9'
Depth of Hole: 27.5'

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. MW-4
Page 1 of 1
Date Installed 6/10/88
Case No.

Client EG&G, IDAHO, INC.

Project AMTL, WATERTOWN — Location SW BOUND. 60

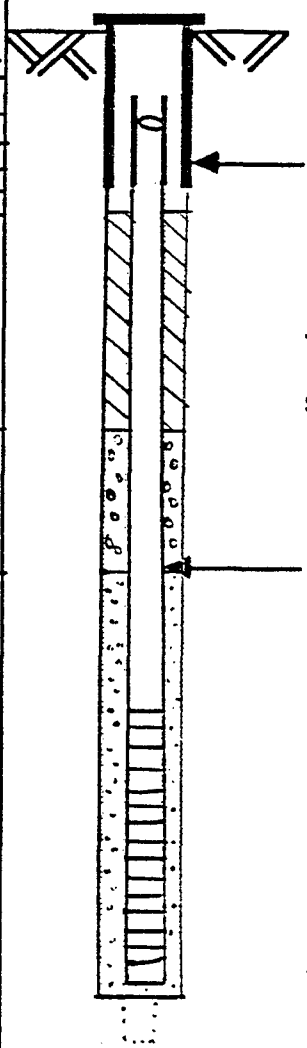
Contractor GZA DRILLING — Supervised By RICHARD PENDLETON

Drill Method AUGER — Total Depth 37.0' SPLIT SPOON, 35.0' HSA — Hole Diameter 12 1/8"

Grout Method BENTONITE CEMENT — Development Method PUMP

Measuring Point Elevation — Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
CRS. SAND, GRAVAL, COBBLE FILL	MW-01	0.0	CEMENT
			SAND
	MW-02	5.0	BENTONITE
	AMTL-515 - THRU 517		SAND
	MW-03	10.0	GROUT
	MW-04 MW GEOTECH-1	15.0	BENTONITE
	MW-GEOTECH-2 MW-GEOTECH-3		
	MW-05	20.0	
FN - CRS SAND AND GRAVAL	MW-06	25.0	SAND
INTERBEDDED SILTY FN. SAND AND CLAY	MW-07	30.0	
	MW-08	35.0	
END OF BORING @ 35.0' SPLIT SPOON 37.0'		40.0	
		45.0	
		50.0	



Elevation of Manhole / Well Riser: ____

Protective Casing Type/Diameter: STEEL / 6 1/4" / LOCK CAP

Protective Casing Interval: 3 3/8" - 3.5'

Type of Surface Seal: CEMENT / SAND / BENTONITE
Sealed Interval: 0.0 - 5.8'

Well Casing Type/Diameter: PVC SCHED. 40 / 4"
Cased Interval: 7 3/8" - 24.7

Type of Grout: BENTONITE CEMENT
Grouted Interval: 5.8' - 14.5
4 bags

Type of Seal: Bentonite
Sealed Interval: 14.5 - 19.6
4 pails

Type of Pack: Silica Sand
Packed Interval: 19.6' - 35.0'
11 bags

Type of Screen: PVC
Screen Size: 0.010"

Screened Interval: 24.7 - 34.7
Depth of Hole: 35.0'

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. MW-05
Page 1 of 1
Date Installed 6/14/88
Case No.

Client E.G. & G. Idaho, Inc.

Project AMTL Watertown, MA.
Location Grass terrace between N. Beacon St. and Storage Tanks.

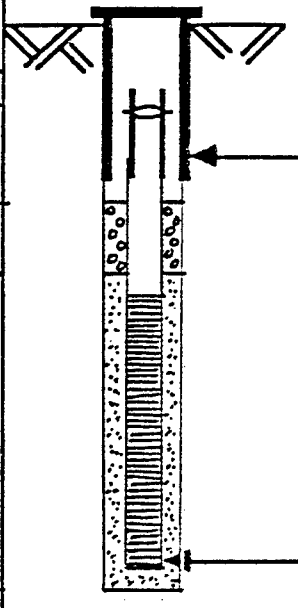
Contractor G.Z.A. Drilling, Inc.
Supervised By Jeffrey W. Fortner, Weston Geophysical Corp.

Drill Method Auger
Total Depth 20.0'
Hole Diameter 12 1/8"

Grout Method None
Development Method Pump

Measuring Point Elevation
Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
Top Soil	MW5-01	0.0'	Cement
Silty Sand	MW5-02	5.0'	Bentonite Pellets
	AMTL-43, 45, 46		
	MW5-03 AMTL-44, 47, 48, 49	10.0'	Quartz Sand
Medium Sand	MW5-04, AT. Lab, SY. ANA., SP. GY.	15.0'	
	MW5-05	20.0'	
		25.0'	
		30.0'	
		35.0'	
		40.0'	
		45.0'	
		50.0'	



Elevation of Manhole / Well Riser
Protective Casing Type/Diameter: 6 1/4" Steel w/Lock Cap
Protective Casing Interval: 4.5" - 3.5'
Type of Surface Seal: Cement
Sealed Interval: ~~0.0'~~ → 5.2' ~~0.0'~~
Well Casing Type/Diameter: 4" PVC
Cased Interval: ~~7.5"~~ → -9.0' 8 1/2"
Type of Grout: None
Grouted Interval: None
Type of Seal: Bentonite 4 Pellets Buckets
Sealed Interval: -5.2' → -8.0'
Type of Pack: Quartz Sand 17 Bags
Packed Interval: -8.0' → -20.0'
Type of Screen: 4" PVC
Screen Size: 10 Slot
Screened Interval: -9.0' → -19.0'
Depth of Hole: -20.0'

Arthur D. Little, Inc.
EG&G FLUSH
GROUNDWATER MONITORING WELL

Well No. MW-06
Page 1 of 1
Date Installed 5/27/88
Case No.

Client E.G. & G. IDAHO, INC.

Project AMTL WATERTOWN, MA.
Location S.E. OF EXPLOSIVES BUNKERS ≈ 70.0'

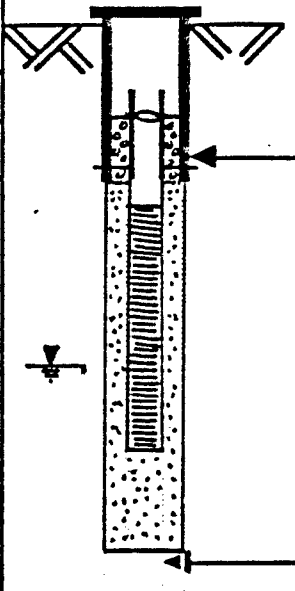
Contractor G.Z.A. DRILLING, INC.
Supervised By JEFFREY W. FORTNER, WESTON GEOPHYSICAL CORP.

Drill Method AUGER
Total Depth 19.0'
Hole Diameter 12 1/8"

Grout Method NONE
Development Method PUMP

Measuring Point Elevation
Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
TOP SOIL		0.0'	CEMENT
	MW6-01		BENTONITE PELLETS
FILL + SLAG	MW6-02		
	AMTL 34, 35, 36	5.0'	
SILTY SAND W/ GRAVEL			QUARTZ SAND
	MW6-03		
SANDY CLAY W/ GRAVEL		10.0'	
VERY FINE SILTY SAND	MW6-04, SV. ANAL., S.G., AT. LIMITS.	15.0'	
	MW6-05	20.0'	
	SPOON DEPTH	25.0'	
		30.0'	
		35.0'	
		40.0'	
		45.0'	
		50.0'	



Elevation of Manhole / Well Riser
Protective Casing Type/Diameter: 6"x4" STEEL W/LOCK CAP
Protective Casing Interval: -2" → -3'2"
Type of Surface Seal: CEMENT — 8 BAGS
Sealed Interval: 0.0' → 1.0'

Well Casing Type/Diameter: 4" PVC
Cased Interval: -4" → -5.0'

Type of Grout: NONE
Grouted Interval: NONE

Type of Seal: BENTONITE PELLETS — 3 BUCKETS
Sealed Interval: -1.0' → -4.0'

Type of Pack: QUARTZ SAND — 13 BAGS
Packed Interval: -4.0' → -19.0'

Type of Screen: 4" PVC
Screen Size: 10 SLOT

Screened Interval: -5.0' → 15.0'
Depth of Hole: 19.0'

Arthur D. Little, Inc.
EG&G FLUSH
GROUNDWATER MONITORING WELL

Well No. MØ-07
Page 1 of 1
Date Installed 6/16/88
Case No.

Client E.G. & G. IDAHO, INC.

Project AMTL WATERTOWN, MA.

Location GRASS STRIP, ALONG FENCE N.E. OF COLENGLS HOUSE.

Contractor GZA DRILLING

Supervised By JEFFREY W. FORTNER / JESTON GEOPHYSICAL CORP.

Drill Method AUGER

Total Depth 39.0'

Hole Diameter 12 1/8"

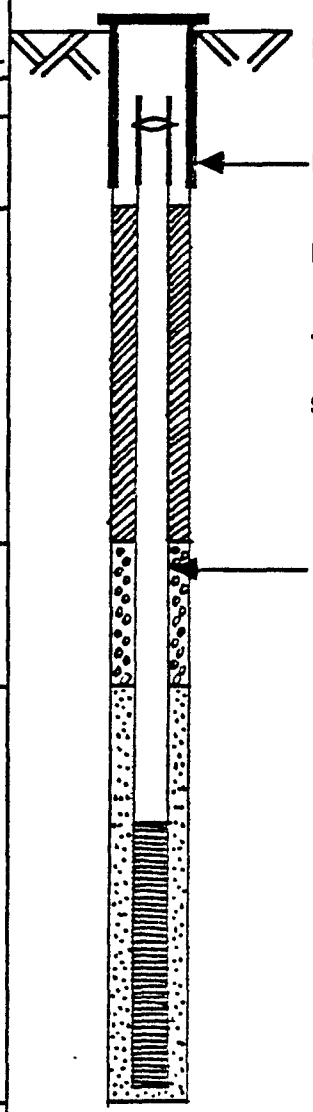
Grout Method CEMENT/BENTONITE SLURRY w/ TREMMIE PIPE

Development Method PUMP

Measuring Point Elevation

Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
	MØ7-01, AT LAB SV ANA, SP ANA	0.0'	
	MØ7-02 AMTL-53,54,55	5.0'	CEMENT
	MØ7-03	10.0'	GROUT
FINE → COARSE SAND	MØ7-04	15.0'	
	MØ7-05	20.0'	BENTONITE PELLETS
	MØ7-06	25.0'	QUARTZ SAND
	MØ7-Ø7	30.0'	
	MØ7-08	35.0'	
		40.0'	
		45.0'	
		50.0'	



Elevation of Manhole Well Riser: -0.68

Protective Casing Type/Diameter: 6¼" STEEL w/LOCK CAP

Protective Casing Interval: 0.41 - 4.0'

Type of Surface Seal: CEMENT
Sealed Interval: 0.0' - 5.0'

Well Casing Type/Diameter: 4" PVC
Cased Interval: 0.68 → -28.0'

Type of Grout: 8 BAGS CEMENT/BENTONITE
Grouted Interval: -5.0' → -18.0'

Type of Seal: BENTONITE PELLETS BUCKETS
Sealed Interval: -18.0' → -23.0'

Type of Pack: QUARTZ SAND BAGS
Packed Interval: -23.0' → -39.0'

Type of Screen: 4" PVC
Screen Size: 10 SLOT

Screened Interval: -28.0' → -38.0'
Depth of Hole: -39.0'

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. MØ-08
Page 1 of 1
Date Installed 6/17/88
Case No.

Client E.G. & G. IDAHO, INC.

Project AMTL WATERTOWN, MA.
Location GRASS MEDIAN EAST OF BLDG. 37

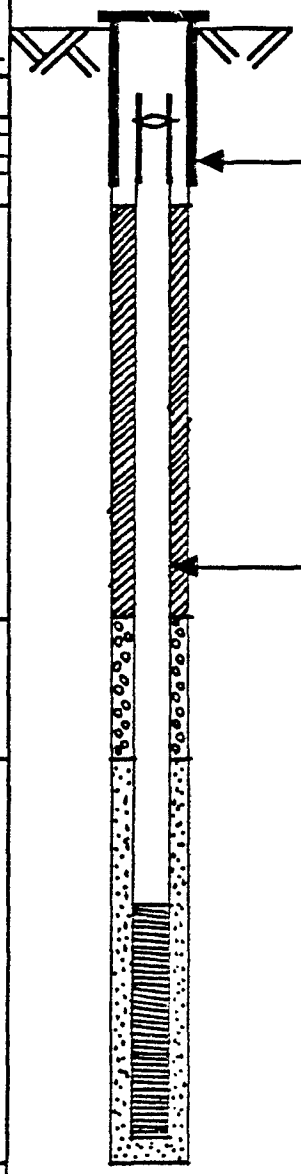
Contractor G.Z.A. DRILLING, INC.
Supervised By JEFFREY W. FORTNER, WESTON GEOPHYSICAL CORP.

Drill Method AUGER
Total Depth 42.0'
Hole Diameter 12 1/8"

Grout Method CEMENT/BENTONITE SLURRY W/TREMMIE PIPE
Development Method PUMP

Measuring Point Elevation
Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
		0.0'	CEMENT SAND BENTONITE SAND
SILTY SAND	MB-01		
	AMTL-55, 56, 57		
	MØB-02 AT. LMT. SV. ANA., SP. GV.	5.0'	
	MØB-03	10.0'	
FINE → COARSE SAND			GROUT
	MB-04	16.0'	
	MØB-05	20.0'	
			BENTONITE PELLETS
	MØB-06	25.0'	
MEDIUM SAND			QUARTZ SAND
	MØB-07	30.0'	
	MØB-08	35.0'	
	MØB-09	40.0'	
		45.0'	
		50.0'	



Elevation of Manhole Well Riser: -0.59
Protective Casing Type/Diameter: 6¼" STEEL W/LOCK CAP
Protective Casing Interval: 0.20 - 4.0'
Type of Surface Seal: CEMENT/SAND/BENTON.
Sealed Interval: 0.0' → -5.0'
Well Casing Type/Diameter: 4" PVC
Cased Interval: -5" → -81.0'
Type of Grout: CEMENT/BENTONITE
Grouted Interval: -5.0' → -21.0'
Type of Seal: BENTONITE PELLETS BUCKETS
Sealed Interval: -21.0' → -26.0'
Type of Pack: QUARTZ SAND BAGS
Packed Interval: -26.0' → -42.0'
Type of Screen: 4" PVC
Screen Size: 10 SLOT
Screened Interval: -31.0' → -41.0'
Depth of Hole: -42.0'

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. MØ-09 *
Page 1 of 1
Date Installed 5/26/88
Case No.

Client E.G. & G. IDAHO, INC.

Project AMTL WATERTOWN, MA.
Location N. OF N.W. CORNER OF BLDG. #43 BY FENCE NEAR ROAD

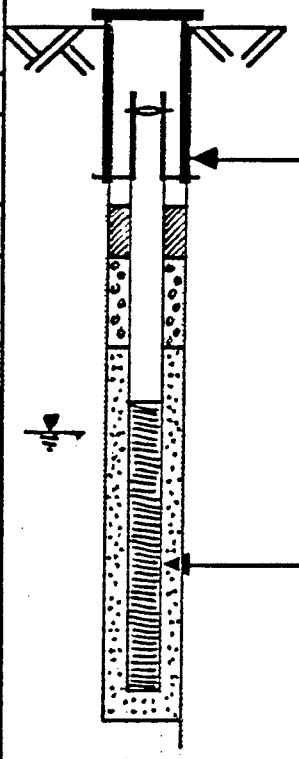
Contractor G.Z.A. DRILLING, INC.
Supervised By JEFFREY W. FORTNER, WESTON GEOPHYSICAL CORP.

Drill Method AUGER
Total Depth 25.0'
Hole Diameter 12 1/8"

Grout Method CEMENT/BENTONITE SLURRY FROM ABOVE *
Development Method PUMP

Measuring Point Elevation
Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
TOP SOIL	MØ9-01	0.0'	CEMENT
FILL	MØ9-02	5.0'	GROUT
	MØ9-03		BENTONITE PELLETS
	AMTL-18,19,20	10.0'	
SANDY-SILT W/ GRAVEL	MØ9-04	15.0'	QUARTZ SAND
	MØ9-05	20.0'	
MEDIUM SAND GRADING INTO SILTY SAND W/ DEPTH	AT. LIMITS, SA., SH. ANAL.	25.0'	
	MØ9-06		
BOTTOM OF SPOON		30.0'	
		35.0'	
		40.0'	
		45.0'	
		50.0'	



Elevation of Manhole
Well Riser

Protective Casing Type/Diameter: 6 1/4" STEEL W/LOCK CAP

Protective Casing Interval: -2" → -3'11"

Type of Surface Seal: CEMENT, 10 BAGS
Sealed Interval: 0.0' → -5.0'

Well Casing Type/Diameter: 4" PVC
Cased Interval: -5" → -13.5'

Type of Grout: 3 BAGS CEMENT/BENTONITE
Grouted Interval: -5.0' → -7.5'

Type of Seal: BENTONITE PELLETS, 5 BUCKETS
Sealed Interval: -7.5' → -11.5'

Type of Pack: QUARTZ SAND, 13 BAGS
Packed Interval: -11.5' → -25.0'

Type of Screen: 4" PVC
Screen Size: 10 SLOT

Screened Interval: -13.5' → 23.5'
Depth of Hole: -25.0'

* APPROVED BY HARRY WOODS USATHAMA.

Arthur D. Little, Inc.
EG&G FLUSH
GROUNDWATER MONITORING WELL

Well No. MB-10
Page 1 of 1
Date Installed 6/1/88
Case No.

Client E.G. & G. IDAHO, INC.

Project AMTL WATERTOWN, MA.
Location N.W. CORNER OF AMTL, N.W. OF BLDG. 246

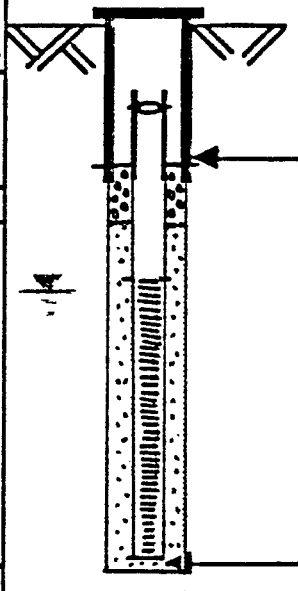
Contractor G.Z.A. DRILLING, INC.
Supervised By JEFFREY W. FORTNER, WESTON GEOPHYSICAL CORP.

Drill Method AUGER
Total Depth 19.0'
Hole Diameter 12¼"

Grout Method NONE
Development Method PUMP

Measuring Point Elevation
Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
FILL	MIO-01	0.0'	CONCRETE
SANDY SILT	AMTL-37,38,39		
	MIO-02	5.0'	BENTONITE
MEDIUM SAND	MIO-03	10.0'	QUARTZ SAND
COBBLES			
INTERFINGER CLAYEY-SILTS AND SILTY CLAYS W/ FINE SANDS	MIO-04	15.0'	
	AT. LMT., S.G., SV. ANALY.		
	MIO-05	20.0'	
SPOON DEPTH		25.0'	
		30.0'	
		35.0'	
		40.0'	
		45.0'	
		50.0'	



Elevation of Manhole
Well Riser
Protective Casing Type/Diameter 6¼" STEEL W/LOCK CAP
Protective Casing Interval -2" → 3'5"
Type of Surface Seal 8 CONCRETE BAGS
Sealed Interval 0.0' → 4.0'
Well Casing Type/Diameter 4" PVC
Cased Interval -5" → -8.0'
Type of Grout NONE
Grouted Interval NONE
Type of Seal 3 BENTONITE PELLETS BUCKETS
Sealed Interval -4.0' → -6.5'
Type of Pack 17 QUARTZ SAND BAGS
Packed Interval -6.5' → -19.0'
Type of Screen 4" PVC
Screen Size 10 SLOT
Screened Interval -8.0' → -18.0'
Depth of Hole -19.0'

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. MØ-11
Page 1 of 1
Date Installed 6/14/88
Case No.

Client E.G. & G. IDAHO, INC.

Project AMTL WATERTOWN, MA.

Location GRASS TERRACE ½ WAY BETWEEN MØ-05 AND MØ-06.

Contractor GZA. DRILLING, INC.

Supervised By JEFFREY W. FORTNER, WESTON GEOPHYSICAL CORP.

Drill Method AUGER

Total Depth 16.0'

Hole Diameter 12 ¼"

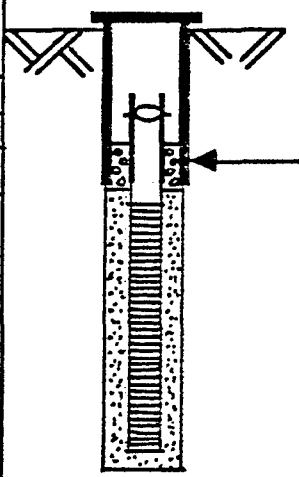
Grout Method NONE

Development Method PUMP

Measuring Point Elevation

Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
TOP SOIL		0.0'	
	M11-01		CEMENT
SILTY SAND	AT. LMT., SY. ANA. SP. GV.		BENTONITE PELLETS
	M11-02	5.0'	
	AMTL-50, 51, 52		
VARYING SILTY SANDS	M11-03	10.0'	QUARTZ SAND
	M11-04	15.0'	
		20.0'	
		25.0'	
		30.0'	
		35.0'	
		40.0'	
		45.0'	
		50.0'	



Elevation of Manhole / Well Riser: ____

Protective Casing Type/Diameter: 6¼" STEEL W/LOCK CAP

Protective Casing Interval: 13⅜" - 2.5'

Type of Surface Seal: CEMENT
Sealed Interval: 0.0' → -1.5'

Well Casing Type/Diameter: 4" PVC
Cased Interval: -5" → -5.0'

Type of Grout: NONE
Grouted Interval: NONE

Type of Seal: BENTONITE PELLETS 3 BUCKETS
Sealed Interval: -1.5' → -4.0'

Type of Pack: QUARTZ SAND 10 BAGS
Packed Interval: -4.0' → -16.0'

Type of Screen: 4" PVC
Screen Size: 10 SLOT

Screened Interval: -5.0' → -15.0'
Depth of Hole: -16.0'

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. MW-12
Page 1 of 1
Date Installed 5/24/88
Case No.

Client E.G. & G. IDAHO, INC.

Project AMTL WATERTOWN, MA.
Location EAST END OF TRAFFIC ISLAND BETWEEN BUILDING 39 AND 131

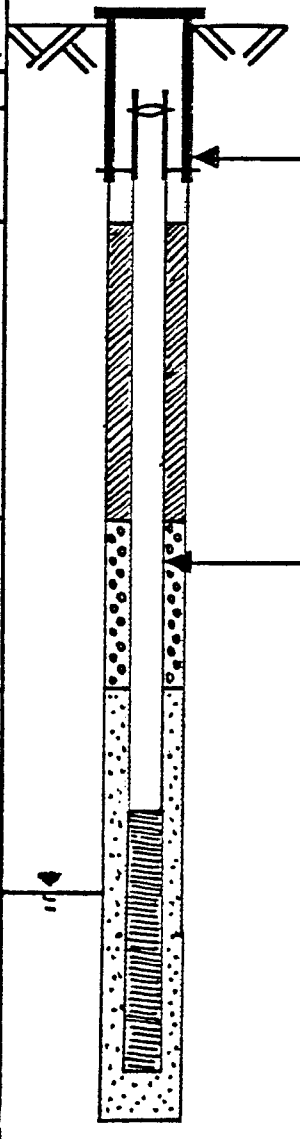
Contractor G.Z.A. DRILLING, INC.
Supervised By RICHARD PENDLETON WESTON GEOPHYSICAL CORP.

Drill Method AUGER
Total Depth 39.0' H.S.A. 41.0' SPOON
Hole Diameter 12 1/8"

Grout Method BENTONITE CEMENT w/MICRO BEAD
Development Method PUMP (SUBMERSIBLE)

Measuring Point Elevation
Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
TOP SOIL FILL	MW12-01	0.0'	CEMENT
MED. SAND w/GRAVEL			
MED-COARSE SAND w/ GRAVEL	AMTL-12,13,14	5.0'	
	MW-12-02		
		10.0'	GROUT
FN-MED SAND w/SILT	MW12-03		
MED. SAND AND GRAVAL	AT. LMTS., S.C., SV. ANAL.		
FN.-MED SAND W. SILT	MW12-04	15.0'	
SILTY FN. SAND SOME GRAVAL	MW12-05	20.0'	BENTONITE PELLETS
FN-MED SAND SOME GRAVAL	MW12-06	25.0'	QUARTZ SAND
FN-MED SAND	MW12-07	30.0'	
GRAVAL CLAYEY SILT, FN. SAND	MW12-08	35.0'	
SILTY FN-MED SAND AND GRAVAL	MW12-09	40.0'	
		45.0'	
		50.0'	



Elevation of Manhole
Well Riser

Protective Casing Type/Diameter 6¼" STEEL w/LOCKCAP
Protective Casing Interval -0.3' → -3.9'

Type of Surface Seal 8 CEMENT BAGS
Sealed Interval 0.0' → -5.8'

Well Casing Type/Diameter 4" PVC
Cased Interval -0.5' → -28.0'

Type of Grout 5 BAGS CEMENT/BENTONITE
Grouted Interval -5.8' → -17.7'

Type of Seal BENTONITE PELLETS 7 BUCKETS
Sealed Interval -17.7' → -23.2'

Type of Pack QUARTZ SAND 18 BAGS
Packed Interval -23.2' → -39.0'

Type of Screen 4" PVC
Screen Size .010 SLOT

Screened Interval -28.0' → -38.0'
Depth of Hole -39.0' H.S.A.
-41.0' SPOON

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. MW-13
Page 1 of 1
Date Installed 6/10/88
Case No.

Client E.G. & G. IDAHO, INC.

Project AMTL WATERTOWN, MA.

Location GRASS STRIP BETWEEN BLDG. #311 AND ARSENAL ST. & 100' FROM N.W. CORNER OF 311.

Contractor G.Z.A. DRILLING, INC

Supervised By JEFFREY J. FORTNER, WESTON GEOPHYSICAL CORP.

Drill Method AUGER

Total Depth 22.0'

Hole Diameter 12 1/2"

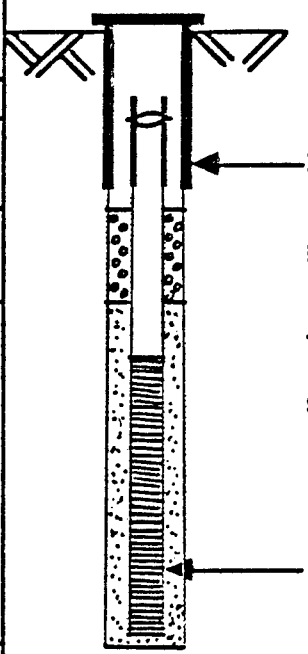
Grout Method NONE

Development Method PUMP

Measuring Point Elevation

Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
TOP SOIL	MW-01	0.0'	CEMENT
SILT	MW-02	5.0'	BENTONITE PELLETS
MEDIUM SAND	MW-03 AMTL-40, 41, 42	10.0'	QUARTZ SAND
FINE → COARSE SAND w/ COBBLES	MW-04	15.0'	
FINE SAND		20.0'	
SANDY SILT	MW-05, AT. LAB., SY. ANL., SP. GV., T.D. U.S.A.	25.0'	
		30.0'	
		35.0'	
		40.0'	
		45.0'	
		50.0'	



Elevation of Manhole Well Riser: -0.46'

Protective Casing Type/Diameter: 6¼" STEEL w/LOCK CAP

Protective Casing Interval: 0.15 - 4.0'

Type of Surface Seal: CEMENT
Sealed Interval: 0.0' → -5.0'

Well Casing Type/Diameter: 4" PVC
Cased Interval: -5" → -11.5'

Type of Grout: NONE
Grouted Interval: NONE

Type of Seal: BENTONITE PELLETS 6 BUCKETS
Sealed Interval: -5.0' → -9.5'

Type of Pack: QUARTZ SAND 12 BAGS
Packed Interval: -9.5' → -22.0'

Type of Screen: 4" PVC
Screen Size: 10 SLOT

Screened Interval: -11.5' → -21.5'
Depth of Hole: -22.0'

Arthur D. Little, Inc.
EG&G FLUSH GROUNDWATER MONITORING WELL

Well No. MW-14
Page 1 of 1
Date Installed 5/20/88
Case No.

Client E. G. & G. IDAHO, INC.

Project AMTL WATERTOWN, MA.
Location W. SW. CORNER OF BLDG. #311

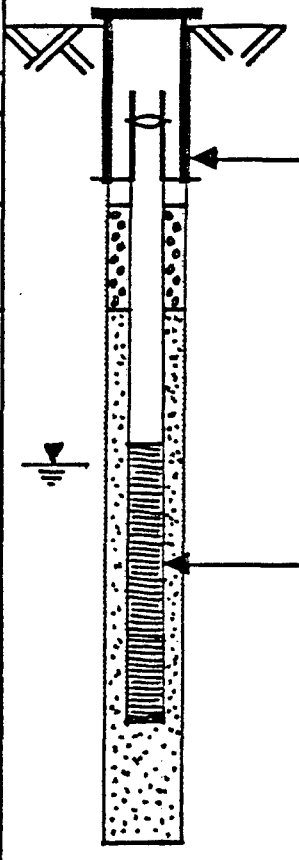
Contractor G. Z. A. DRILLING, INC.
Supervised By JEFFREY W. FORTNER, WESTON GEOPHYSICAL CORP.

Drill Method AUGER
Total Depth 29.0'
Hole Diameter 12 1/8"

Grout Method NONE
Development Method PUMP

Measuring Point Elevation
Ground Surface Elevation

STRAT.	SAMPLE INTERVAL	DEPTH (BELOW GRADE)	BACKFILL MATERIAL
TOP SOIL	MW4-01	0.0'	CEMENT
FILL	MW4-02	5.0'	BENTONITE PELLETS
MED-COARSE SAND w/ GRAV.-COB.	AMTL-06,07,08		
	MW4-03	10.0'	
CLAYEY-SILT			QUARTZ SAND
	MW4-04	15.0'	
	SW-1		
INTER-BEDDED w/	MW4-05	20.0'	
SILTY-CLAY	MW4-06	25.0'	
	MW4-07	30.0'	
BOTTOM OF SPOON		35.0'	
		40.0'	
		45.0'	
		50.0'	



Elevation of Manhole
Well Riser

Protective Casing Type/Diameter 6 3/4" STEEL w/LOCK CAP

Protective Casing Interval +2" → -3'11"

Type of Surface Seal 8 BAGS CEMENT
Sealed Interval 0.0' → 5.0'

Well Casing Type/Diameter 4" PVC
Cased Interval -5.0' → -15.0'

Type of Grout NONE
Grouted Interval NONE

Type of Seal 6 BUCKETS BENTONITE PELLETS
Sealed Interval -5.0' → -10.0'

Type of Pack 25# QUARTZ SAND BAGS
Packed Interval -10.0' → -29.0'

Type of Screen 4" PVC
Screen Size 10 SLOT

Screened Interval -15.0' → -25.0'
Depth of Hole -29.0'

APPENDIX C

Well Development

NOTE: Hole C01 was not completed as a monitor well. It was abandoned by grouting from 78.2 feet to surface.

Arthur D. Little, Inc.
WELL DEVELOPMENT REPORT

Well No. C-2
Installation Date 5/27
Development Date 6/2

Client EG&G, Idaho
Case No.
Project AMTL
Location Watertown
Depth to Screen Bottom 39.4
Screen Length 15'
Water Level (Relative to Top of PVC Casing)
Before Development 29'
24 Hours After 31.19'

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(39.4) -- (29.0)] = (6.81) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(39.4) -- (29)] = (16.34) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(6.81) + (16.34)] x 5 = (115.73) GALLONS

MEASUREMENTS

	BEFORE	DURING	DURING	AFTER
pH	6.28	6.45	6.50	6.47
CONDUCTIVITY	875	802	858	756

DEPTH TO SEDIMENT: BEFORE _____ AFTER _____

TYPE/CAPACITY OF PUMP Myers ½ H.P. RPM 3450

PUMPING RATE

RECHARGE TIME 10 min

TIME TO DEVELOP WELL 9:30 Am – 1:30 Pm 4 hours

COMMENTS ON WATER REMOVED

2⅓ drums filled

DEVELOPED/SUPERVISED BY [signature]

DATE 6/2/88

Arthur D. Little, Inc.
WELL DEVELOPMENT REPORT

Well No. C-3
Installation Date 6/17/88
Development Date 6/21/88

Client EG&G, IDAHO, INC.
Case No. 61453
Project AMTL
Location WATERTOWN - SE CORNER AMTL
Depth to Screen Bottom 34.6'
Screen Length 10.0'
Water Level (Relative to Top of PVC Casing)
Before Development 8.2'
24 Hours After 8.1'

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]
0.6545 [(34.6) - (8.2)] = (17.3) GALLONS

ANNULAR VOLUME (30% POROSITY)

0.3221 ~~1.571~~ [DEPTH SCREEN BOTTOM -- DEPTH WATER]
0.3221 ~~1.571~~ [(34.6) - (8.2)] = (8.5) GALLONS

FOR 6.5" O.D. AUGER USE 0.3221 GALS PER LINEAR FOOT.

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5
[(17.3) + (8.5)] x 5 = (129.0) GALLONS
+ <10 gal. added during well construction.

RMP per RAL 6/21/88 (see attached sheet)

MEASUREMENTS

	BEFORE	BARREL 1 DURING	BARREL 2 DURING	BARREL 3 AFTER
pH	6.3	6.26	6.30	6.29
CONDUCTIVITY	1337	841	782	769

DEPTH TO SEDIMENT: BEFORE 34.0' AFTER 34.4'
TYPE/CAPACITY OF PUMP ROBIN E425W SUBMERSIBLE / 5-10 GPM
PUMPING RATE 9 mins / 55 gals
RECHARGE TIME
TIME TO DEVELOP WELL START 0850 6/21 END 0920 6/21
COMMENTS ON WATER REMOVED
APROX 1/2" CLAYEY FINSANDY SILT IN FIRST BAR

DEVELOPED/SUPERVISED BY RICHARD PANDOLFINI, ENERGY TECH, DAVE ANDERSON (GZA) DATE 6/21/88

Arthur D. Little, Inc.

WELL DEVELOPMENT REPORT

Well No.	M - 3
Installation Date	5/19/88
Development Date	5/25/88

Client: EG&G, Idaho	Case No.
Project: AMTL	Location: Watertown, MA
Depth to Screen Bottom: 16.5'	Water Level (Relative to Top of PVC Casing) Before Development: 6.1
Screen Length: 10'	24 Hours After: 6.25'

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(16.5) -- (6.23)] = (6.72) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(16.5) -- (6.23)] = (16.1) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(6.72) + (16.1)] x 5 = (114) GALLONS

MEASUREMENTS

	BEFORE	DURING	DURING	AFTER
pH	6.9	6.8	6.97	6.92
CONDUCTIVITY	692	820	849	825

DEPTH TO SEDIMENT: BEFORE _____ AFTER _____

TYPE/CAPACITY OF PUMP: Flow mor 1½" model Z1327 (Suction)

PUMPING RATE: _____ RECHARGE TIME: 5 min

TIME TO DEVELOP WELL: 8:20 AM - 10:24 AM 2 hours

COMMENTS ON WATER REMOVED

W. L. from PVC ref. 6' 1¼"

DEVELOPED/SUPERVISED BY: [signature] DATE: 5/25/88

Arthur D. Little, Inc.

WELL DEVELOPMENT REPORT

Well No. MW-02
Installation Date 5/23/88
Development Date 5/25/88

Client EG&G, Idaho	Case No.
Project AMTL	Location Waterloo, MT
Depth to Screen Bottom 16.0'	Water Level (Relative to Top of PVC Casing) Before Development 8.81'
Screen Length 10'	24 Hours After 9.01'

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(16.0') -- (8.81)] = (4.71) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(16.0) -- (8.81)] = (11.30) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(4.71) + (11.30)] x 5 = (80.05) GALLONS

MEASUREMENTS

	BEFORE	DURING	DURING	AFTER
pH	7.53	7.51	7.49	7.43
CONDUCTIVITY	814	540	557	564

DEPTH TO SEDIMENT: BEFORE _____ AFTER _____

TYPE/CAPACITY OF PUMP Flow max 1½" Model 21377 (suction)

PUMPING RATE | RECHARGE TIME 5 min

TIME TO DEVELOP WELL 11 AM - 1 pm 2 hours

COMMENTS ON WATER REMOVED

Depth to water 8' 9¾" = 8.81'

DEVELOPED/SUPERVISED BY _____ DATE 5/25/88

Arthur D. Little, Inc.
WELL DEVELOPMENT REPORT

Well No. [redacted] M-3
Installation Date
Development Date 6/14/88 - 6/16

Client EG & G
Case No.
Project Watertown, AMTL
Location
Depth to Screen Bottom 26'
Water Level (Relative to Top of PVC Casing)
Before Development 23.65 (Ground Surface)
Screen Length 10'
24 Hours After 23.03' (PVC) 6/21

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]
0.6545 [(26.0) - (23.65)] = (2.54) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]
1.571 [(26.0) - (23.65)] = (3.692) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5
[(1.54) + (3.692)] x 5 = (28.43) GALLONS

MEASUREMENTS

	BEFORE	DURING (3rd P)	DURING	AFTER
pH	9.73	8.15	7.95	7.90
CONDUCTIVITY	1455	171.0	2170	2200

DEPTH TO SEDIMENT: BEFORE _____ AFTER _____

TYPE/CAPACITY OF PUMP Myers ½ H.P. RPM - 3450

PUMPING RATE | RECHARGE TIME 30 min

TIME TO DEVELOP WELL 9:00 Am 6/14 - 8:45 6/16 48 hours

COMMENTS ON WATER REMOVED

Water level has dropped since drilling was at 13.0 feet

⅔ barrels filled

DEVELOPED/SUPERVISED BY [signature] DATE 6/16/88

Arthur D. Little, Inc.
WELL DEVELOPMENT REPORT

Well No.	MW-4
Installation Date	6/10/88
Development Date	6/13

Client: EG&G	Case No.
Project: AMTL, Watertown	Location: MA
Depth to Screen Bottom: 34.7	Water Level (Relative to Top of PVC Casing) Before Development: 28.4
Screen Length: 10'	24 Hours After: 26.64

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(34.7) -- (28.5)] = (4.058) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(34.7) -- (28.5)] = (9.74) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(4.058) + (9.74)] x 5 = (68.99) GALLONS

MEASUREMENTS

	BEFORE	DURING	DURING	AFTER
pH	8.80	8.43	8.78	8.70
CONDUCTIVITY	258	201	1.76	1.59

DEPTH TO SEDIMENT: BEFORE _____ AFTER _____

TYPE/CAPACITY OF PUMP: Myers 1/2 H.P. RPM 3450

PUMPING RATE: _____ RECHARGE TIME: 10 min

TIME TO DEVELOP WELL: 8:45 1:010 PM ... 4 hrs 15 min

COMMENTS ON WATER REMOVED

DEVELOPED/SUPERVISED BY: [signature] DATE: 6/13/88

Arthur D. Little, Inc.
WELL DEVELOPMENT REPORT

Well No. MW-5
Installation Date 6/14/88
Development Date 6/20-6/21/88

Client EG&G IDAHO	Case No. 61457
Project AM-1	Location WATERTOWN MA
Depth to Screen Bottom 19.0'	Water Level (Relative to Top of PVC Casing) Before Development 10.0'
Screen Length 10.0'	24 Hours After ~~10.2'~~ RF 9.7

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(19.0') -- (10')] = (5.9) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(19.0') -- (10.0')] = (14.1) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(5.9) + (14.1)] x 5 = (100) GALLONS

MEASUREMENTS

	BEFORE	DURING	DURING	AFTER
pH	6.30	5.22	5.21	5.51
CONDUCTIVITY	122	132	148	127

DEPTH TO SEDIMENT: BEFORE _____ AFTER _____

TYPE/CAPACITY OF PUMP MYERS 1/2 H.P. 3450 RPM

PUMPING RATE | RECHARGE TIME 15 MINUTES

TIME TO DEVELOP WELL START 1400 6/20 STOP 1600 START 0630 END 1030 6/21

COMMENTS ON WATER REMOVED

Started 13:30 6/20/88 pump @ 10 gals every 15 to 20 min

Pumped 2 bbls

DEVELOPED/SUPERVISED BY L. HALL, R. PENDLETON, D. ANDERSEN (EG&G) DATE 6/21/88

Arthur D. Little, Inc.
WELL DEVELOPMENT REPORT

Well No. M-06
Installation Date 5/27/88
Development Date 6/3/88

Client EG & G, Idaho	Case No.
Project AMTL	Location Watertown, MA
Depth to Screen Bottom 15.0	Water Level (Relative to Top of PVC Casing) Before Development 7.07'
Screen Length 10'	24 Hours After 12.37

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(15.0) -- (7.07)] = (12.46) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(~~15.0~~) -- (~~12.46~~ 7.07)] = (12.46) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(5.19) + (12.46)] x 5 = (88.24) GALLONS

MEASUREMENTS

	BEFORE	DURING	DURING	AFTER
pH	5.88	5.40	5.47	5.60
CONDUCTIVITY	1400	1350	1300	1250

DEPTH TO SEDIMENT: BEFORE _____ AFTER _____

TYPE/CAPACITY OF PUMP Flow max 1½" Model 21327

PUMPING RATE

RECHARGE TIME 10-15 min

TIME TO DEVELOP WELL 7:30AM - 2:10PM

COMMENTS ON WATER REMOVED

Filled 1¾ drums

DEVELOPED/SUPERVISED BY _____ DATE 6/3/88

Arthur D. Little, Inc.
WELL DEVELOPMENT REPORT

Well No. MW-7
Installation Date 6/16/88
Development Date 6/21/88

Client - GC IDAHO	Case No. 61453
Project AMTL	Location WATERTOWN MA
Depth to Screen Bottom 38.0'	Water Level (Relative to Top of PVC Casing) Before Development 29'
Screen Length 10.0'	24 Hours After RP ~~33.77'~~ 34.53'

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(38.0') -- (29.0')] = (5.9) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(38.0) -- (29.0)] = (14.1) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(5.9) + (14.1)] x 5 = (100.2) GALLONS

MEASUREMENTS

	BEFORE	DURING	DURING	AFTER
pH	~~6.99~~	6.88	6.88 RP ~~6.94~~	6.95
CONDUCTIVITY	192.7	187.3	183.4 RP ~~192.7~~	181.0

DEPTH TO SEDIMENT: BEFORE ~~39.5~~ RP AFTER RP ~~40.55'~~ 37.15'

TYPE/CAPACITY OF PUMP ROBIN EY25W - SUBMERSIBLE

PUMPING RATE 7 gpm / 55 gal. RECHARGE TIME PUMPED CONTINUOUS

TIME TO DEVELOP WELL START 0720 6/21/88 END 0745 6/21/88

COMMENTS ON WATER REMOVED

DEVELOPED/SUPERVISED BY RICHARD PENDLETON DANFORTH (W2A7) DATE 6/21/88

Arthur D. Little, Inc.
WELL DEVELOPMENT REPORT

Well No. MW-8
Installation Date 6/17/88
Development Date 6/21/88

Client E G & G	Case No.
Project AMTL	Location [illegible] MA
Depth to Screen Bottom 41.0'	Water Level (Relative to Top of PVC Casing) Before Development 33.5'
Screen Length 10.0'	24 Hours After 33.37'

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(41.0) - (33.50')] = (4.9) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(41.0) - (33.50')] = (11.8) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(4.9) + (11.8)] x 5 = (83.4) GALLONS

MEASUREMENTS

	BEFORE	DURING (~50 gals)	DURING	AFTER
pH	6.67	6.80	6.83	6.91
CONDUCTIVITY	523	531	532	535

DEPTH TO SEDIMENT: BEFORE 41.0' AFTER 41.0'

TYPE/CAPACITY OF PUMP ROBIN ~~E45~~ 20 E125W - SUBMERSIBLE

PUMPING RATE 7/min 155 gal. RECHARGE TIME CONTINUOUS PUMPING

TIME TO DEVELOP WELL START 0818 6/21 STOP PUMP 0912 START PUMP 0918 END 0827 6/21

COMMENTS ON WATER REMOVED

APROX 1/4" SILTY CLAY BROWN, SETTLES OUT OF FIRST JAR, 4TH JAR SLIGHTLY CLOUDY, NO SETTLING.

DEVELOPED/SUPERVISED BY R. PEDERSEN / L. HALL / D. ANDERSEN (GEI) DATE 6/21

Arthur D. Little, Inc.

WELL DEVELOPMENT REPORT

Well No. M-09
Installation Date ~~5/25~~ 5/26
Development Date 6/2/88

Client: EG&G, Idaho
Case No.:
Project: AMTL
Location: Watertown
Depth to Screen Bottom: 23.5
Screen Length: 10'
Water Level (Relative to Top of PVC Casing)
Before Development: 14.62
24 Hours After: 14.98

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(23.5) - (14.62)] = (5.81) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(25.0) - (14.62)] = (16.30) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(5.81) + (16.30)] x 5 = (110.53) GALLONS

MEASUREMENTS

	BEFORE	DURING	DURING	AFTER
pH	7.42	6.86	6.72	6.65
CONDUCTIVITY	790	1520	1522	1534

DEPTH TO SEDIMENT: BEFORE _____ AFTER _____

TYPE/CAPACITY OF PUMP: Myers ½ HP RPM 3450

PUMPING RATE:

RECHARGE TIME:

TIME TO DEVELOP WELL: 7:45 - 8:15 AM ½ hour

COMMENTS ON WATER REMOVED

pumped continuously

DEVELOPED/SUPERVISED BY [signature]

DATE 6/2/88

Arthur D. Little, Inc.
WELL DEVELOPMENT REPORT

Well No.	M-10
Installation Date	5/31/88
Development Date	6/6/88

Client: EG & G, Idaho	Case No.
Project: AMTL	Location: Watertown, MA
Depth to Screen Bottom: 18'	Water Level (Relative to Top of PVC Casing)
Screen Length: 10'	Before Development: 10'.0
	24 Hours After: 9.14'

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(18.0) - (10.0)] = (5.236) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(18.0) - (10.0)] = (12.57) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(5.236) + (12.57)] x 5 = (89.02) GALLONS

MEASUREMENTS

	BEFORE	DURING	DURING	AFTER
pH	8.24	8.40	8.63	8.53
CONDUCTIVITY	354	2.77	279	260

DEPTH TO SEDIMENT: BEFORE _____ AFTER _____

TYPE/CAPACITY OF PUMP: Flow Mor 1½" Model 21327

PUMPING RATE: _____ RECHARGE TIME: 20 min

TIME TO DEVELOP WELL: 7:45 Am - 2 pm 6 hrs 15 minutes

COMMENTS ON WATER REMOVED

DEVELOPED/SUPERVISED BY: _____ DATE: 6/6/88

Arthur D. Little, Inc.
WELL DEVELOPMENT REPORT

Well No. MW-11
Installation Date 6/14/88
Development Date 6/21-6/22/88

Client EG & G IDAHO	Case No. 61453
Project AMTL	Location WATERTOWN MA
Depth to Screen Bottom 15.0'	Water Level (Relative to Top of PVC Casing) Before Development 5.68
Screen Length 10.0'	24 Hours After 5.98'

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(~~15.1~~ RP 15.0) - (5.68)] = (6.1) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(15.0) - (5.63)] = (14.6) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(6.1) + (14.6)] x 5 = (104) GALLONS

MEASUREMENTS

	BEFORE	6/21 DRUM 1 DURING	6/21 DRUM 2 DURING	6/22 AFTER
pH	5.85	5.64	5.90	5.88
CONDUCTIVITY	156	153	151	150

DEPTH TO SEDIMENT: BEFORE 13.90' AFTER 14.5'

TYPE/CAPACITY OF PUMP STARTED WITH ROBIN E42SW SUBMERSIBLE (1" - 3450 RPM) FINISHED WITH MYERS 1/2 H.P. 3450 RPM (1045 6/21)

PUMPING RATE 1 MINUTE TO DRY WELL | RECHARGE TIME 10-15 MINS.

TIME TO DEVELOP WELL START 1016 6/21 WAIT 20-30 MINS BETWEEN OVERNIGHT END 1000 6/22

COMMENTS ON WATER REMOVED

3 MINUTES TO DRY WELL.

TWO FULL DRUMS REMOVED.

SAMPLES #1, #2 & #3 WERE LIGHT BROWN WITH SAND AND SILT.

SAMPLE #4 AS SAMPLE #3

DEVELOPED/SUPERVISED BY RICHARD PENDLETON DATE 6/21/88

Arthur D. Little, Inc.
WELL DEVELOPMENT REPORT

Well No. M-12
Installation Date 5/24/88
Development Date 6/1/88

Client EG&G, Idaho	Case No.
Project AMTL	Location Watertown, MA
Depth to Screen Bottom 37.4	Water Level (Relative to Top of PVC Casing) Before Development 31.97
Screen Length 10.0	24 Hours After 32.05

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(37.4) -- (31.97)] = (3.55) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(37.4) -- (31.97)] = (8.53) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(3.55) + (8.53)] x 5 = (60.4) GALLONS

MEASUREMENTS

	BEFORE	DURING	DURING	AFTER
pH	6.95	6.60	6.52	6.25
CONDUCTIVITY	1711	1745	1729	1692

DEPTH TO SEDIMENT: BEFORE _____ AFTER _____

TYPE/CAPACITY OF PUMP Myers ½ H.P. RPM 3450

PUMPING RATE

RECHARGE TIME 10 min

TIME TO DEVELOP WELL 10 Am - 2:30 pm ... 4½ hours

COMMENTS ON WATER REMOVED

filled 1⅓ Drums with development water

DEVELOPED/SUPERVISED BY Thomas R. Wood

DATE 6/1/88

Arthur D. Little, Inc.
WELL DEVELOPMENT REPORT

Well No. MW 13
Installation Date 6/16/88
Development Date 6/20-21/88

Client [illegible]	Case No. [illegible]
Project [illegible]	Location [illegible] MA
Depth to Screen Bottom 21.5'	Water Level (Relative to Top of PVC Casing) Before Development 13.9'
Screen Length 10.0'	24 Hours After 12.25'

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(21.5') -- (13')] = (5.6) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(21.5) -- (13)] = (13.4) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(5.6) + (13.4)] x 5 = (94.8) GALLONS

MEASUREMENTS

	BEFORE	DURING	DURING	AFTER
pH	[illegible] 5	[illegible]	[illegible]	6.51
CONDUCTIVITY	[illegible]	[illegible]	[illegible]	2045

DEPTH TO SEDIMENT: BEFORE _____ AFTER _____

TYPE/CAPACITY OF PUMP Robbins Eyles Submersible 15-18 GPM

PUMPING RATE 5:30 - [illegible] mm/55 GAL

RECHARGE TIME [illegible]

TIME TO DEVELOP WELL [illegible] START [illegible] 1:30 6/21 END 08:30 6/21

COMMENTS ON WATER REMOVED

[illegible]

DEVELOPED/SUPERVISED BY [illegible]

DATE [illegible]

Arthur D. Little, Inc.

WELL DEVELOPMENT REPORT

Well No. M-14
Installation Date 5/20/88
Development Date 5/26/88

Client EG&G, Idaho	Case No.
Project AMTL	Location Watertown, MA
Depth to Screen Bottom 25.0'	Water Level (Relative to Top of PVC Casing) Before Development 15.32
Screen Length 10'	24 Hours After 15.56

WELL VOLUME

0.6545 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

0.6545 [(25.0) - (15.32)] = (6.36) GALLONS

ANNULAR VOLUME (30% POROSITY)

1.571 [DEPTH SCREEN BOTTOM -- DEPTH WATER]

1.571 [(25.0) - (15.32)] = (15.21) GALLONS

WATER TO BE REMOVED

(WELL VOLUME + ANNULAR VOLUME) x 5

[(6.36) + (15.207)] x 5 = (107.84) GALLONS

MEASUREMENTS

	BEFORE	DURING	DURING	AFTER
pH	7.76	7.10	6.60	6.48
CONDUCTIVITY	307	38	438	473

DEPTH TO SEDIMENT: BEFORE _____ AFTER _____

TYPE/CAPACITY OF PUMP Flow max 1½" Model 21327

PUMPING RATE | RECHARGE TIME 10

TIME TO DEVELOP WELL 9:30 AM - 2:30 PM 5 hours

COMMENTS ON WATER REMOVED

DEVELOPED/SUPERVISED BY [signature] DATE 2/11/88

APPENDIX D

Water Levels

NOTE: Hole C01 was not completed as a monitor well. It was abandonded by grouting from 78.2 feet to surface.

Arthur D. Little, Inc.

GROUNDWATER MONITORING REPORT

Well No. C-2

Page 1 of

Date Installed 5

Client EG & G, Idaho, Inc.

Case No.

Project AMTL Watertown, MA

Location C-2

Measuring Point

DESCRIPTION manhole

ELEVATION 37.49

Equipment Used

Johnson water marker electric water level tape

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
5/31/88	8:30		PVC	~29'		difficult to determine W.L due to fouling of probe	TRW
6/6/88	3:38			31' 2¼"			
6/30/88	12:20		manhole	31' 7½"			CBM
7/13			manhole	31.630	5.86		CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.
GROUNDWATER MONITORING REPORT

Well No. C03
Page 1 of 1
Date Installed
Case No.

Client EG&G FOMIL

Project ATTIL WATER TOWN

Location

Measuring Point
DESCRIPTION manhole
ELEVATION 11.9

Equipment Used
Electric water level meter

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
7/13/88			manhole	8.448	3.45		JBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.
GROUNDWATER MONITORING REPORT

Well No. MW - 1
Page 1 of
Date Installed 5/18/88
Case No.

Client E G & G IDAHO, INC.

Project AMTL WATERTOWN, MA.
Location MW-1

Measuring Point Manhole
DESCRIPTION GROUND SURFACE
ELEVATION 24.93

Equipment Used
JOHNSON WATER MARKER ELECTRIC WATER LEVEL TAPE

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
5/20/88	11:15	2	GRND.SUR.	6.7'		GROUND SURFACE LEVEL ESTIMATED TO ±0.1'	RMP
5/23/88	0900	5	GRND SUR	7.00		G.S. Approx.	TRW
5/24/88	9:57	6	mark on PVC (N)	6.23'			J.W.F.
5/25/88	8:15	7	M.P. on PVC	6.10'		~~[illegible]~~	TRW
5/26/88	8:30	8	M.P. PVC	6.06'		↑prior to development	TRW
5/31/88	9:20	12	M.P. PVC	6.01'			J.W.F.
6/6/88	2:58	18	M.P. on PVC	6'3 3/8"			TRW
6/29/88	11:35	31	manhole	7'4 3/4"			CBM
7/13/88		45	manhole	7.562	17.42		CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.
GROUNDWATER MONITORING REPORT

Well No. MW-02
Page 1 of
Date Installed 5/23/88
Case No.

Client E.G.+G IDAHO, INC.

Project AMTL WATERTOWN, MA

Location ON GRASS, ALONG FENCE SOUTH CENTER OF BLDG. 292.

Measuring Point
DESCRIPTION Top of PVC (4")
ELEVATION 24.04

Equipment Used
M-SCOPE (ELECTRIC H_2O METER)

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
5/23/88	3:10	6 HRS.	TOP OF PVC	8.85'			J.W.F.
5/24/88	10:02	1	MARK ON PVC (N)	8.88'			J.W.F.
5/25/88	10:45	2	M.P.	8.81			TRW
5/26/88	8:15	3	M.P.	8.83			TRW
5/31/88	9:30	7	M.P.	8.98			J.W.F.
6/6/88	3:12	6	M.P.	9' 1/8"			TRW
6/29/88	11:45	19	manhole	10' 3 5/8"			CBM
7/13/88		33	manhole	10.490	13.55		CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.

GROUNDWATER MONITORING REPORT

Well No. M-3

Page _____ of _____

Date Installed 6/13/88

Client EG & G

Case No.

Project AMTL, Watertown

Location

Measuring Point

DESCRIPTION _____

ELEVATION 36.63

Equipment Used

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
6/14/88	10:15		~~g.s.~~ Approx	23.65		surface well not completed or developed	TRW
6/24/88	12:45		manhole	23' 7"			CBM
7/13/88			manhole	23.750	12.88		CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.
GROUNDWATER MONITORING REPORT

Well No. M-4
Page ____ of ____
Date Installed
Case No.

Client EG&G

Project AMTL, Watertown

Location

Measuring Point
DESCRIPTION ____
ELEVATION 36.52

Equipment Used

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
6/14/88	10:15		G.S. Approx			Surface not complete developed yesterday	TRW
6/29/88	12:05		~~manhole~~ PVC	28' 5 5/8"			CBM
7/13/88			manhole	29.188	7.33		CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.

GROUNDWATER MONITORING REPORT

Well No. M05

Page 1 of 1

Date Installed

Case No.

Client EG&G, Idaho

Project AMTL, Watertown

Location

Measuring Point to manhole elev.

DESCRIPTION

ELEVATION 15.93

Equipment Used

Electric water level meter

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
7/13/88			manhole	10.873	5.107		CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.
GROUNDWATER MONITORING REPORT

Well No. MW-06
Page 1 of
Date Installed 5/27/88
Case No.

Client EG+G IDAHO, INC.

Project AMTL WATERTOWN, MA.

Location 12' WEST OF C-3 IN S.E. CORNER BY S.E. GATE S. OF COLONELS HOUSE.

Measuring Point
DESCRIPTION
ELEVATION 11.96

Equipment Used

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
5/27/88	1:30	0	GRD. SURF.	7.3'			J.W.F.
5/31/88	8:55	4	TOP OF PVC	7.07'			J.W.F.
6/6/88	4:15	10	M.P.	12' 4½"		developed on 6/3	TRW
6/29/88	1:05	23	manhole	8' 7⅛"			CBM
7/13/88		37	manhole	8.146	3.81		CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.

GROUNDWATER MONITORING REPORT

Well No. MW7

Page 1 of 1

Date Installed

Client EG&G, Idaho Inc.

Case No.

Project AMTL WATERDOM

Location

Measuring Point manhole

DESCRIPTION

ELEVATION 3984

Equipment Used

Electric water level meter

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
7/13/88			manhole	29.667			CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.

GROUNDWATER MONITORING REPORT

Well No. M08

Page 1 of 1

Date Installed

Case No.

Client EG+G IDAHO

Project ANITL WATERTOWN

Location

Measuring Point Marble

DESCRIPTION

ELEVATION 39.98

Equipment Used

Electric water level meter

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
7/3/88			marble	33.703			CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.

GROUNDWATER MONITORING REPORT

Well No. MW-09

Page 1 of

Date Installed MAY 26, 1988

Client EG&G IDAHO, INC.

Case No.

Project AMTL WATERTOWN, MA.

Location

Measuring Point

DESCRIPTION

ELEVATION 37.03

Equipment Used

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
5/31/88	9:07	5	TOP OF PVC	14.62'			J.W.F.
6/6/88	3:26	11	M.P.	14.' 11 3/4"			TRW
6/29/88	10:40	24	manhole	16' 3 1/2"			CBM
7/13/88		38	manhole	16.771	20.26		CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.
GROUNDWATER MONITORING REPORT

Well No. MW-10
Page 1 of
Date Installed JUNE 1, 1988
Case No.

Client E.G. & G. IDAHO, INC.

Project AMTL WATERTOWN, MA.

Location NW. OF COMPLEX
NW OF BLDG #246

Measuring Point
DESCRIPTION MARK ON PVC
ELEVATION 32.86

Equipment Used
M-SCOPE ELECTRIC H_2O METER

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
6/9/88	11:20		mark on PVC (N)	9.14'			J.W.F.
6/29/88	11:00		manhole	10' 5 3/4"			CBM
7/13/88			manhole	11.000	21.86		CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.

GROUNDWATER MONITORING REPORT

Well No. M 11

Page 1 of 1

Date Installed

Case No.

Client EG&G Idaho

Project AMTL WATERTOWN

Location

Measuring Point

DESCRIPTION

ELEVATION 11.01

Equipment Used

Electric water level meter

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
7/13/88			marked	6.167	4.84		CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.
GROUNDWATER MONITORING REPORT

Well No. MW-12

Page 1 of

Date Installed

Case No.

Client EG+G IDAHO, INC

Project ADL WATERTOWN, MA.

Location

Measuring Point

DESCRIPTION

ELEVATION 38.52

Equipment Used

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
5/26/88	7:30		GRD. SURF.	32.05'			T.R.W
5/31/88	8:50		TOP OF PVC	31.97'			RMP
6/6/88	3:47		M.P.	32' 5/8"			TRW
6/29/88	11:00		manhole	32' 9 1/4"		2.5 ppm	CBM
7/13/88			manhole	32.135	6.38		CBM

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.

GROUNDWATER MONITORING REPORT

Well No. M13

Page 1 of 1

Date Installed

Client EG+G IDAHO

Case No.

Project ANTL WATERTOWN

Location

Measuring Point

DESCRIPTION _____

ELEVATION 35.30

Equipment Used

Electric Water level meter.

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
7/13/88			marked	13.188	22.11		CBR

*DAYS SINCE WELL INSTALLATION

Arthur D. Little, Inc.
GROUNDWATER MONITORING REPORT

Well No. MW-10
Page 1 of
Date Installed 5/20/88
Case No.

Client B.G. & G. Idaho, Inc.

Project AMTL Watertown, MA.

Location N.SW. Corner of Bldg. 31

Measuring Point
DESCRIPTION Top of PVC
ELEVATION 35.49

Equipment Used Electric H.O meter (M-Scope)

DATE	TIME	ELAPSED TIME*	MEAS. POINT	WATER DEPTH	WATER ELEVATION	REMARKS	READ BY
5/20/88	11:05 A	0	surface elevation	16.32'			J.W.F.
5/23/88	0800	3	surface elev	~~16.55~~	?	G.S. Approx. 24, 2 PVC	TRW
5/24/88	10:08	4	mark on PVC (N)	16.29'			J.W.F.
5/25/88	13:30	5	M.P.	16.51			TRW
5/26/88	8:00	6	M.P. on PVC	15.32		Double checked measurement	TRW
5/31/88	9:15	10	M.P. on PVC	16.30			J.W.F.
6/6/88	2:44	16	M.P. on PVC	15.63/4'		drilling C-1 ~~here~~ same day	TRW
6/29/88	11:25	29	manhole	17'5"			CBM
7/13/88		43	manhole	17.188			CBM

*DAYS SINCE WELL INSTALLATION

APPENDIX E

Hydraulic Tests

NOTE: Hole C01 was not completed as a monitor well. It was abandonded by grouting from 78.2 feet to surface.

Unit# 00000 Test# 3
RISING C-2
INPUT 1: Level (F) TOC

Reference	0.00
Scale factor	100.86
Offset	0.00

Step# 0 06/23 11:03

Elapsed Time	Value
0.0000	0.00
0.0033	0.44
0.0066	1.14
0.0099	0.89
0.0133	0.89
0.0166	0.47
0.0200	0.60
0.0233	0.73
0.0266	0.89
0.0300	1.23
0.0333	1.90
0.0500	2.54
0.0666	2.41
0.0833	2.28
0.1000	2.16
0.1166	2.06
0.1333	1.97
0.1500	1.90
0.1666	1.81
0.1833	1.71
0.2000	1.65
0.2166	1.58
0.2333	1.49
0.2500	1.43
0.2666	1.36
0.2833	1.30
0.3000	1.23
0.3166	1.20
0.3333	1.14
0.4167	0.85
0.5000	0.63
0.5833	0.47
0.6667	0.41
0.7500	0.38
0.8333	0.31
0.9167	0.31
1.0000	0.31
1.0833	0.28
1.1667	0.28
1.2500	0.28
1.3333	0.28
1.4166	0.28
1.5000	0.28
1.5833	0.25
1.6667	0.25
1.7500	0.25
1.8333	0.25
1.9167	0.25
2.0000	0.25
2.5000	0.25
3.0000	0.25
3.5000	0.22
4.0000	0.22
4.5000	0.22
5.0000	0.22
5.5000	0.22
6.0000	0.19
6.5000	0.19
7.0000	0.19
7.5000	0.19
8.0000	0.19
8.5000	0.19
9.0000	0.19
9.5000	0.19
10.0000	0.19
12.0000	0.19
14.0000	0.19

END

63

Unit# 00000 Test# 2
FALLING C-2
INPUT 1: Level (F) TOC

Reference	0.00
Scale factor	100.86
Offset	0.00

Step# 0 06/23 10:50

Elapsed Time	Value
0.0000	- 2.54
0.0033	- 2.32
0.0066	- 2.03
0.0099	- 1.68
0.0133	- 1.43
0.0166	- 1.58
0.0200	- 0.85
0.0233	- 1.14
0.0266	- 0.76
0.0300	0.66
0.0333	- 0.79
0.0500	- 0.50
0.0666	- 0.41
0.0833	- 0.38
0.1000	- 0.31
0.1166	- 0.28
0.1333	- 0.25
0.1500	- 0.25
0.1666	- 0.22
0.1833	- 0.22
0.2000	- 0.19
0.2166	- 0.19
0.2333	- 0.19
0.2500	- 0.19
0.2666	- 0.15
0.2833	- 0.15
0.3000	- 0.15
0.3166	- 0.15
0.3333	- 0.15
0.4167	- 0.15
0.5000	- 0.15
0.5833	- 0.12
0.6667	- 0.12
0.7500	- 0.12
0.8333	- 0.12
0.9167	- 0.12
1.0000	- 0.12
1.0833	- 0.12
1.1667	- 0.12
1.2500	- 0.09
1.3333	- 0.09
1.4166	- 0.09
1.5000	- 0.09
1.5833	- 0.09
1.6667	- 0.09
1.7500	- 0.09
1.8333	- 0.09
1.9167	- 0.09
2.0000	- 0.09
2.5000	- 0.09
3.0000	- 0.09
3.5000	- 0.06
4.0000	- 0.06
4.5000	- 0.06
5.0000	- 0.06
5.5000	- 0.06
6.0000	- 0.06
6.5000	- 0.06
7.0000	- 0.06
7.5000	- 0.06
8.0000	- 0.06
8.5000	- 0.03
9.0000	- 0.03
9.5000	- 0.03
10.0000	- 0.03
12.0000	0.00

END

70

Unit# 00000 Test# 1
RISING C-3
INPUT 1: Level (F) TOC

Reference	0.00
Scale factor	100.86
Offset	0.00

Step# 0 06/23 08:20

Elapsed Time	Value
0.0000	1.68
0.0033	0.73
0.0066	0.66
0.0099	0.85
0.0133	1.33
0.0166	2.06
0.0200	2.70
0.0233	2.86
0.0266	2.67
0.0300	2.57
0.0333	2.54
0.0500	2.32
0.0666	2.16
0.0833	2.03
0.1000	1.90
0.1166	1.81
0.1333	1.71
0.1500	1.58
0.1666	1.52
0.1833	1.43
0.2000	1.36
0.2166	1.27
0.2333	1.20
0.2500	1.14
0.2666	1.08
0.2833	1.04
0.3000	0.98
0.3166	0.95
0.3333	0.89
0.4167	0.69
0.5000	0.57
0.5833	0.44
0.6667	0.38
0.7500	0.31
0.8333	0.25
0.9167	0.22
1.0000	0.19
1.0833	0.19
1.1667	0.15
1.2500	0.15
1.3333	0.12
1.4166	0.12
1.5000	0.12
1.5833	0.09
1.6667	0.09
1.7500	0.09
1.8333	0.09
1.9167	0.09
2.0000	0.09
2.5000	0.06
3.0000	0.03
3.5000	0.03
4.0000	0.03
4.5000	0.03
5.0000	0.03
5.5000	0.03
6.0000	0.03
6.5000	0.00
7.0000	0.03
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00
12.0000	0.00

END
READY

Unit# 00000 Test# 0
FALLING C-3
INPUT 1: Level (F) TOC

Reference	0.00
Scale factor	100.86
Offset	0.00

Step# 0 06/23 08:05

Elapsed Time	Value
0.0000	- 2.32
0.0033	- 2.47
0.0066	- 2.70
0.0099	- 2.67
0.0133	- 2.44
0.0166	- 2.22
0.0200	- 2.16
0.0233	- 1.97
0.0266	- 1.62
0.0300	- 1.55
0.0333	- 1.71
0.0500	- 2.32
0.0666	- 1.04
0.0833	- 1.58
0.1000	- 1.46
0.1166	- 1.39
0.1333	- 1.30
0.1500	- 1.23
0.1666	- 1.14
0.1833	- 1.08
0.2000	- 1.01
0.2166	- 0.98
0.2333	- 0.92
0.2500	- 0.85
0.2666	- 0.82
0.2833	- 0.76
0.3000	- 0.73
0.3166	- 0.69
0.3333	- 0.66
0.4167	- 0.50
0.5000	- 0.41
0.5833	- 0.34
0.6667	- 0.28
0.7500	- 0.22
0.8333	- 0.19
0.9167	- 0.15
1.0000	- 0.15
1.0833	- 0.12
1.1667	- 0.12
1.2500	- 0.12
1.3333	- 0.09
1.4166	- 0.09
1.5000	- 0.09
1.5833	- 0.09
1.6667	- 0.09
1.7500	- 0.06
1.8333	- 0.06
1.9167	- 0.06
2.0000	- 0.06
2.5000	- 0.06
3.0000	- 0.03
3.5000	- 0.03
4.0000	- 0.03
4.5000	- 0.03
5.0000	- 0.03
5.5000	- 0.03
6.0000	- 0.03
6.5000	- 0.03
7.0000	- 0.03
7.5000	- 0.03
8.0000	- 0.03
8.5000	- 0.03
9.0000	- 0.03
9.5000	- 0.03
10.0000	- 0.03
12.0000	- 0.03

END

Unit# 00001 Test# 1
RISING M-01
INPUT 1: Level (F) TOC

Reference	0.00
Scale factor	100.86
Offset	0.00

Step# 0 06/20 09:37

Elapsed Time	Value
0.0000	1.62
0.0033	0.50
0.0066	1.84
0.0099	2.38
0.0133	2.92
0.0166	2.70
0.0200	2.67
0.0233	2.63
0.0266	2.60
0.0300	2.57
0.0333	2.51
0.0500	2.35
0.0666	2.22
0.0833	2.06
0.1000	1.93
0.1166	1.81
0.1333	1.68
0.1500	1.55
0.1666	1.46
0.1833	1.33
0.2000	1.23
0.2166	1.11
0.2333	1.01
0.2500	0.95
0.2666	0.85
0.2833	0.79
0.3000	0.73
0.3166	0.66
0.3333	0.60
0.4167	0.47
0.5000	0.41
0.5833	0.41
0.6667	0.38
0.7500	0.34
0.8333	0.34
0.9167	0.34
1.0000	0.31
1.0833	0.31
1.1667	0.31
1.2500	0.28
1.3333	0.28
1.4166	0.28
1.5000	0.28
1.5833	0.28
1.6667	0.28
1.7500	0.25
1.8333	0.25
1.9167	0.25
2.0000	0.25
2.5000	0.22
3.0000	0.19
3.5000	0.19
4.0000	0.19
4.5000	0.15
5.0000	0.15
5.5000	0.12
6.0000	0.12
6.5000	0.12
7.0000	0.09
7.5000	0.09
8.0000	0.09
8.5000	0.09
9.0000	0.09
9.5000	0.09
10.0000	0.06

END

Unit# 00001 Test# 0
FALLING M-01
INPUT 1: Level (F) TOC

Reference	0.00
Scale factor	100.86
Offset	0.00

Step# 0 06/20 09:24

Elapsed Time	Value
0.0000	- 2.03
0.0033	- 1.90
0.0066	- 2.32
0.0099	- 2.98
0.0133	- 2.12
0.0166	- 3.36
0.0200	- 3.14
0.0233	- 3.11
0.0266	- 3.24
0.0300	- 3.14
0.0333	- 2.86
0.0500	- 1.74
0.0666	- 1.36
0.0833	- 1.23
0.1000	- 1.04
0.1166	- 0.98
0.1333	- 0.92
0.1500	- 0.85
0.1666	- 0.82
0.1833	- 0.76
0.2000	- 0.73
0.2166	- 0.73
0.2333	- 0.69
0.2500	- 0.66
0.2666	- 0.66
0.2833	- 0.63
0.3000	- 0.63
0.3166	- 0.63
0.3333	- 0.60
0.4167	- 0.60
0.5000	- 0.57
0.5833	- 0.54
0.6667	- 0.50
0.7500	- 0.47
0.8333	- 0.47
0.9167	- 0.44
1.0000	- 0.44
1.0833	- 0.41
1.1667	- 0.41
1.2500	- 0.38
1.3333	- 0.38
1.4166	- 0.38
1.5000	- 0.34
1.5833	- 0.34
1.6667	- 0.34
1.7500	- 0.31
1.8333	- 0.31
1.9167	- 0.31
2.0000	- 0.31
2.5000	- 0.28
3.0000	- 0.25
3.5000	- 0.22
4.0000	- 0.19
4.5000	- 0.19
5.0000	- 0.19
5.5000	- 0.15
6.0000	- 0.15
6.5000	- 0.15
7.0000	- 0.12
7.5000	- 0.12
8.0000	- 0.12
8.5000	- 0.12
9.0000	- 0.12
9.5000	- 0.09
10.0000	-

END

1st
3,30, 7.50

0.15
chloride
weight

Unit# 00001 Test# 3
RISING M-02
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/20 10:59

Elapsed Time	Value
0.0000	2.79
0.0033	2.76
0.0066	2.73
0.0099	2.70
0.0133	2.67
0.0166	2.63
0.0200	2.60
0.0233	2.57
0.0266	2.54
0.0300	2.51
0.0333	2.47
0.0500	2.35
0.0666	2.22
0.0833	2.12
0.1000	2.06
0.1166	1.97
0.1333	1.93
0.1500	1.87
0.1666	1.84
0.1833	1.78
0.2000	1.74
0.2166	1.71
0.2333	1.68
0.2500	1.65
0.2666	1.62
0.2833	1.58
0.3000	1.58
0.3166	1.55
0.3333	1.52
0.4167	1.43
0.5000	1.36
0.5833	1.33
0.6667	1.27
0.7500	1.23
0.8333	1.20
0.9167	1.30
1.0000	1.23
1.0833	1.20
1.1667	1.17
1.2500	1.14
1.3333	1.11
1.4166	1.08
1.5000	1.04
1.5833	1.01
1.6667	0.98
1.7500	0.95
1.8333	0.92
1.9167	0.89
2.0000	0.89
2.5000	0.76
3.0000	0.66
3.5000	0.60
4.0000	0.47
4.5000	0.41
5.0000	0.41
5.5000	0.34
6.0000	0.31
6.5000	0.31
7.0000	0.28
7.5000	0.25
8.0000	0.25
8.5000	0.25
9.0000	0.22
9.5000	0.22
10.0000	0.22
12.0000	0.22
14.0000	0.15
16.0000	0.15

END

Unit# 00001 Test# 2
FALLING M-02
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/20 10:44

Elapsed Time	Value
0.0000	0.44
0.0033	- 2.09
0.0066	- 0.98
0.0099	- 0.54
0.0133	- 1.17
0.0166	- 0.69
0.0200	- 0.95
0.0233	- 0.76
0.0266	- 0.79
0.0300	- 0.76
0.0333	- 0.73
0.0500	- 0.69
0.0666	- 0.63
0.0833	- 0.60
0.1000	- 0.57
0.1166	- 0.57
0.1333	- 0.54
0.1500	- 0.50
0.1666	- 0.50
0.1833	- 0.50
0.2000	- 0.50
0.2166	- 0.47
0.2333	- 0.47
0.2500	- 0.47
0.2666	- 0.47
0.2833	- 0.47
0.3000	- 0.44
0.3166	- 0.44
0.3333	- 0.44
0.4167	- 0.44
0.5000	- 0.41
0.5833	- 0.41
0.6667	- 0.38
0.7500	- 0.38
0.8333	- 0.38
0.9167	- 0.34
1.0000	- 0.34
1.0833	- 0.34
1.1667	- 0.34
1.2500	- 0.34
1.3333	- 0.31
1.4166	- 0.31
1.5000	- 0.31
1.5833	- 0.31
1.6667	- 0.31
1.7500	- 0.28
1.8333	- 0.28
1.9167	- 0.28
2.0000	- 0.28
2.5000	- 0.25
3.0000	- 0.25
3.5000	- 0.22
4.0000	- 0.22
4.5000	- 0.19
5.0000	- 0.19
5.5000	- 0.19
6.0000	- 0.15
6.5000	- 0.15
7.0000	- 0.15
7.5000	- 0.15
8.0000	- 0.12
8.5000	- 0.12
9.0000	- 0.12
9.5000	- 0.12
10.0000	- 0.12
12.0000	- 0.09

END

Weston Geophysical

Unit# 00000 Test# 7
RISING M-03
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/29 11:46

Elapsed Time	Value
0.0000	0.73
t=0 ← -0.0033	0.76
0.0066	0.73
0.0099	0.69
0.0133	0.66
0.0166	0.66
-0.0200	0.63
0.0233	0.60
0.0266	0.57
-0.0300	0.54
0.0333	0.54
-0.0500	0.41
0.0666	0.38
0.0833	0.31
-0.1000	0.31
0.1166	0.28
0.1333	0.28
-0.1500	0.25
0.1666	0.25
0.1833	0.25
-0.2000	0.25
0.2166	0.25
0.2333	0.25
-0.2500	0.22
0.2666	0.22
0.2833	0.22
-0.3000	0.22
0.3166	0.22
0.3333	0.22
0.4167	0.22
-0.5000	0.19
0.5833	0.19
0.6667	0.19
-0.7500	0.19
0.8333	0.19
0.9167	0.19
-1.0000	0.19
1.0833	0.19
1.1667	0.19
-1.2500	0.19
1.3333	0.19
1.4166	0.19
-1.5000	0.19
1.5833	0.19
1.6667	0.19
-1.7500	0.19
1.8333	0.19
1.9167	0.19
-2.0000	0.19
-2.5000	0.15
-3.0000	0.15
-3.5000	0.15
-4.0000	0.15
-4.5000	0.15
-5.0000	0.15
-5.5000	0.15
-6.0000	0.15
-6.5000	0.15
-7.0000	0.15
-7.5000	0.12
-8.0000	0.12
-8.5000	0.12
-9.0000	0.12
-9.5000	0.12
-10.0000	0.12
-10.5000	0.12

END

Unit# 00000 Test# 6
FALLING M-03
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/29 11:30

Elapsed Time	Value
0.0000	- 0.69
-0.0033	- 0.76
0.0066	- 0.76
0.0099	- 0.69
0.0133	- 0.50
0.0166	- 0.38
-0.0200	- 0.34
0.0233	- 0.31
0.0266	- 0.28
-0.0300	- 0.25
0.0333	- 0.25
-0.0500	- 0.22
0.0666	- 0.19
0.0833	- 0.19
-0.1000	- 0.15
0.1166	- 0.15
0.1333	- 0.15
-0.1500	- 0.15
0.1666	- 0.15
0.1833	- 0.15
-0.2000	- 0.15
0.2166	- 0.15
0.2333	- 0.15
-0.2500	- 0.15
0.2666	- 0.15
0.2833	- 0.15
-0.3000	- 0.15
0.3166	- 0.15
0.3333	- 0.15
0.4167	- 0.15
-0.5000	- 0.15
0.5833	- 0.12
0.6667	- 0.15
-0.7500	- 0.12
0.8333	- 0.12
0.9167	- 0.12
-1.0000	- 0.12
1.0833	- 0.12
1.1667	- 0.12
-1.2500	- 0.12
1.3333	- 0.12
1.4166	- 0.12
-1.5000	- 0.12
1.5833	- 0.09
1.6667	- 0.12
-1.7500	- 0.12
1.8333	- 0.09
1.9167	- 0.09
-2.0000	- 0.09
-2.5000	- 0.09
-3.0000	- 0.09
-3.5000	- 0.09
-4.0000	- 0.06
-4.5000	- 0.06
-5.0000	- 0.06
-5.5000	- 0.06
-6.0000	- 0.06
-6.5000	- 0.06
-7.0000	- 0.03
-7.5000	- 0.03
-8.0000	- 0.03
-8.5000	- 0.03
-9.0000	- 0.03
-9.5000	- 0.03
-10.0000	- 0.03
-10.5000	- 0.03

END

Unit# 00000 Test# 9
RISING M-04
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/29 13:02

Elapsed Time	Value
0.0000	0.76
-0.0033	0.79
0.0066	0.76
0.0099	0.73
0.0133	0.73
0.0166	0.69
-0.0200	0.66
0.0233	0.66
0.0266	0.63
-0.0300	0.63
0.0333	0.60
-0.0500	0.47
0.0666	0.41
0.0833	0.34
-0.1000	0.31
0.1166	0.28
0.1333	0.28
-0.1500	0.25
0.1666	0.25
0.1833	0.22
-0.2000	0.22
0.2166	0.22
0.2333	0.22
-0.2500	0.22
0.2666	0.22
0.2833	0.19
-0.3000	0.19
0.3166	0.19
0.3333	0.19
0.4167	0.19
-0.5000	0.15
0.5833	0.15
0.6667	0.15
-0.7500	0.15
0.8333	0.15
0.9167	0.15
-1.0000	0.15
1.0833	0.15
1.1667	0.12
-1.2500	0.12
1.3333	0.12
1.4166	0.12
-1.5000	0.12
1.5833	0.12
1.6667	0.12
-1.7500	0.12
1.8333	0.12
1.9167	0.12
-2.0000	0.12
-2.5000	0.12
-3.0000	0.09
-3.5000	0.09
-4.0000	0.09
-4.5000	0.09
-5.0000	0.06
-5.5000	0.06
-6.0000	0.06
-6.5000	0.06
-7.0000	0.06
-7.5000	0.06
-8.0000	0.06
-8.5000	0.03
-9.0000	0.06
-9.5000	0.06
-10.0000	0.03
-12.0000	0.03

END

Unit# 00000 Test# 8
FALLING M-04
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/29 12:45

Elapsed Time	Value
0.0000	- 0.95
-0.0033	- 0.85
0.0066	- 0.79
0.0099	0.73
0.0133	- 0.79
0.0166	- 0.47
-0.0200	- 0.22
0.0233	- 0.57
0.0266	- 0.19
-0.0300	- 0.22
0.0333	- 0.38
-0.0500	- 0.19
0.0666	- 0.25
0.0833	- 0.25
-0.1000	- 0.22
0.1166	- 0.22
0.1333	- 0.22
-0.1500	- 0.22
0.1666	- 0.22
0.1833	- 0.22
-0.2000	- 0.22
0.2166	- 0.19
0.2333	- 0.19
-0.2500	- 0.19
0.2666	- 0.22
0.2833	- 0.19
-0.3000	- 0.19
0.3166	- 0.19
0.3333	- 0.19
0.4167	- 0.19
-0.5000	- 0.19
0.5833	- 0.19
0.6667	- 0.19
-0.7500	- 0.19
0.8333	- 0.15
0.9167	- 0.15
-1.0000	- 0.15
1.0833	- 0.15
1.1667	- 0.15
-1.2500	- 0.15
1.3333	- 0.12
1.4166	- 0.12
-1.5000	- 0.12
1.5833	- 0.12
1.6667	- 0.12
-1.7500	- 0.12
1.8333	- 0.12
1.9167	- 0.12
-2.0000	- 0.12
-2.5000	- 0.12
-3.0000	- 0.09
-3.5000	- 0.09
-4.0000	- 0.09
-4.5000	- 0.06
-5.0000	- 0.06
-5.5000	- 0.06
-6.0000	- 0.06
-6.5000	- 0.06
-7.0000	- 0.06
-7.5000	- 0.06
-8.0000	- 0.03
-8.5000	- 0.03
-9.0000	- 0.03
-9.5000	- 0.03
-10.0000	- 0.03
-12.0000	0.00
-14.0000	0.00

END

RISING M-05

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Ster# 0 06/29 07:58

Elapsed Time	Value
0.0000	2.77
0.0033	2.57
0.0066	2.57
0.0099	2.57
0.0133	2.51
0.0166	2.47
0.0200	2.44
0.0233	2.41
0.0266	2.38
0.0300	2.35
0.0333	2.32
0.0500	2.12
0.0666	1.97
0.0833	1.81
0.1000	1.71
0.1166	1.58
0.1333	1.46
0.1500	1.36
0.1666	1.30
0.1833	1.23
0.2000	1.17
0.2166	1.14
0.2333	1.11
0.2500	1.08
0.2666	1.04
0.2833	1.04
0.3000	1.01
0.3166	0.98
0.3333	0.98
0.4167	0.92
0.5000	0.89
0.5833	0.85
0.6667	0.85
0.7500	0.82
0.8333	0.82
0.9167	0.79
1.0000	0.79
1.0833	0.76
1.1667	0.76
1.2500	0.76
1.3333	0.76
1.4166	0.73
1.5000	0.73
1.5833	0.73
1.6667	0.69
1.7500	0.69
1.8333	0.69
1.9167	0.69
2.0000	0.69
2.5000	0.63
3.0000	0.63
3.5000	0.60
4.0000	0.57
4.5000	0.54
5.0000	0.54
5.5000	0.50
6.0000	0.47
6.5000	0.47
7.0000	0.47
7.5000	0.44
8.0000	0.44
8.5000	0.41
9.0000	0.41
9.5000	0.41
10.0000	0.38
12.0000	0.34
14.0000	0.31
16.0000	0.28
18.0000	0.25
20.0000	0.22
22.0000	0.22

FALLING M-05

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Ster# 0 06/29 07:37

Elapsed Time	Value
0.0000	-0.69
0.0033	-0.63
0.0066	-0.63
0.0099	-0.63
0.0133	-0.60
0.0166	-0.60
0.0200	-0.60
0.0233	-0.60
0.0266	-0.60
0.0300	-0.60
0.0333	-0.60
0.0500	-0.60
0.0666	-0.60
0.0833	-0.60
0.1000	-0.57
0.1166	-0.57
0.1333	-0.57
0.1500	-0.57
0.1666	-0.54
0.1833	-0.54
0.2000	-0.54
0.2166	-0.54
0.2333	-0.54
0.2500	-0.54
0.2666	-0.54
0.2833	-0.50
0.3000	-0.50
0.3166	-0.50
0.3333	-0.50
0.4167	-0.50
0.5000	-0.47
0.5833	-0.47
0.6667	-0.47
0.7500	-0.44
0.8333	-0.44
0.9167	-0.44
1.0000	-0.41
1.0833	-0.41
1.1667	-0.41
1.2500	-0.41
1.3333	-0.38
1.4166	-0.38
1.5000	-0.38
1.5833	-0.38
1.6667	-0.38
1.7500	-0.38
1.8333	-0.34
1.9167	-0.34
2.0000	-0.34
2.5000	-0.31
3.0000	-0.28
3.5000	-0.25
4.0000	-0.22
4.5000	-0.22
5.0000	-0.19
5.5000	-0.15
6.0000	-0.15
6.5000	-0.12
7.0000	-0.12
7.5000	-0.09
8.0000	-0.09
8.5000	-0.09
9.0000	-0.06
9.5000	-0.06
10.0000	-0.06
12.0000	0.00
14.0000	0.00
16.0000	0.00
18.0000	0.03

END

RISING HEAD M-06

INPUT 1: Level (F) TOC

Reference	0.00
Scale factor	100.86
Offset	0.00

Step# 0 06/23 16:18

Elapsed Time	Value
0.0000	0.44
0.0033	0.22
0.0066	0.41
0.0099	0.76
0.0133	1.23
0.0166	1.36
0.0200	1.43
0.0233	1.74
0.0266	1.90
0.0300	2.03
0.0333	2.28
0.0500	2.86
0.0666	2.82
0.0833	2.79
0.1000	2.76
0.1166	2.76
0.1333	2.76
0.1500	2.86
0.1666	2.82
0.1833	2.82
0.2000	2.82
0.2166	2.79
0.2333	2.76
0.2500	2.76
0.2666	2.70
0.2833	2.67
0.3000	2.63
0.3166	2.60
0.3333	2.60
0.4167	2.47
0.5000	2.41
0.5833	2.32
0.6667	2.22
0.7500	2.16
0.8333	2.09
0.9167	2.03
1.0000	1.97
1.0833	1.90
1.1667	1.84
1.2500	1.78
1.3333	1.71
1.4166	1.68
1.5000	1.62
1.5833	1.58
1.6667	1.52
1.7500	1.49
1.8333	1.43
1.9167	1.39
2.0000	1.36
2.5000	1.14
3.0000	0.95
3.5000	0.82
4.0000	0.73
4.5000	0.63
5.0000	0.54
5.5000	0.47
6.0000	0.44
6.5000	0.38
7.0000	0.34
7.5000	0.31
8.0000	0.28
8.5000	0.25
9.0000	0.25
9.5000	0.22
10.0000	0.22
12.0000	0.19
14.0000	0.15

END

FALLING M-06

INPUT 1: Level (F) TOC

Reference	0.00
Scale factor	100.86
Offset	0.00

Step# 0 06/23 16:05

Elapsed Time	Value
0.0000	- 2.92
0.0033	- 3.24
0.0066	- 2.76
0.0099	- 3.49
0.0133	- 1.33
0.0166	- 1.81
0.0200	- 3.40
0.0233	- 2.35
0.0266	- 2.47
0.0300	- 2.57
0.0333	- 2.44
0.0500	- 2.44
0.0666	- 2.41
0.0833	- 2.38
0.1000	- 2.35
0.1166	- 2.28
0.1333	- 2.25
0.1500	- 2.22
0.1666	- 2.19
0.1833	- 2.16
0.2000	- 2.12
0.2166	- 2.09
0.2333	- 2.06
0.2500	- 2.03
0.2666	- 2.00
0.2833	- 2.00
0.3000	- 1.97
0.3166	- 1.93
0.3333	- 1.93
0.4167	- 1.84
0.5000	- 1.74
0.5833	- 1.65
0.6667	- 1.58
0.7500	- 1.52
0.8333	- 1.49
0.9167	- 1.43
1.0000	- 1.36
1.0833	- 1.33
1.1667	- 1.27
1.2500	- 1.23
1.3333	- 1.20
1.4166	- 1.17
1.5000	- 1.14
1.5833	- 1.11
1.6667	- 1.08
1.7500	- 1.04
1.8333	- 1.01
1.9167	- 0.98
2.0000	- 0.95
2.5000	- 0.79
3.0000	- 0.66
3.5000	- 0.57
4.0000	- 0.47
4.5000	- 0.41
5.0000	- 0.34
5.5000	- 0.28
6.0000	- 0.25
6.5000	- 0.22
7.0000	- 0.19
7.5000	- 0.15
8.0000	- 0.12
8.5000	- 0.12
9.0000	- 0.09
9.5000	- 0.09
10.0000	- 0.06

END

Unit# 00000 Test# 7
RISING HEAD M-07
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/23 13:52

Elapsed Time	Value
0.0000	0.85
0.0033	0.57
0.0066	0.41
0.0099	0.41
0.0133	0.15
0.0166	0.15
0.0200	0.47
0.0233	0.60
0.0266	0.63
0.0300	0.73
0.0333	0.73
0.0500	0.47
0.0666	0.09
0.0833	0.00
0.1000	0.00
0.1166	0.00
0.1333	0.00
0.1500	0.00
0.1666	0.00
0.1833	0.00
0.2000	0.00
0.2166	0.00
0.2333	0.00
0.2500	0.00
0.2666	0.00
0.2833	0.00
0.3000	0.00
0.3166	0.00
0.3333	0.00
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	-0.03
3.5000	0.00
4.0000	-0.03
4.5000	0.00
5.0000	-0.03
5.5000	0.00
6.0000	0.00
6.5000	-0.03
7.0000	0.00
7.5000	0.00
8.0000	-0.03
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00
12.0000	0.00
14.0000	0.00

END

Unit# 00000 Test# 6
FALLING HEAD M-07
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/23 13:38

Elapsed Time	Value
0.0000	-0.50
0.0033	-0.66
0.0066	-0.34
0.0099	1.27
0.0133	0.15
0.0166	0.12
0.0200	0.00
0.0233	0.03
0.0266	0.00
0.0300	0.00
0.0333	0.03
0.0500	0.00
0.0666	0.00
0.0833	0.00
0.1000	0.00
0.1166	0.00
0.1333	0.00
0.1500	0.00
0.1666	0.00
0.1833	0.03
0.2000	0.00
0.2166	0.00
0.2333	0.03
0.2500	0.00
0.2666	0.00
0.2833	0.00
0.3000	0.00
0.3166	0.00
0.3333	0.03
0.4167	0.00
0.5000	0.00
0.5833	0.00
0.6667	0.00
0.7500	0.00
0.8333	0.00
0.9167	0.00
1.0000	0.00
1.0833	0.00
1.1667	0.00
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	0.00
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	0.00
1.9167	0.00
2.0000	0.00
2.5000	0.00
3.0000	0.00
3.5000	0.00
4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.03
6.5000	0.03
7.0000	0.00
7.5000	0.03
8.0000	0.03
8.5000	0.03
9.0000	0.03
9.5000	0.03
10.0000	0.03

END

Unit# 00000 Test# 5
RISING M-07
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/29 10:25

Elapsed Time	Value
0.0000	0.60
-0.0033	0.69
0.0066	0.63
0.0099	0.47
0.0133	0.38
0.0166	0.28
-0.0200	0.25
0.0233	0.31
0.0266	0.44
-0.0300	0.63
0.0333	0.73
-0.0500	0.82
0.0666	0.69
0.0833	0.79
-0.1000	0.73
0.1166	0.73
0.1333	0.73
-0.1500	0.73
0.1666	0.73
0.1833	0.66
-0.2000	0.57
0.2166	0.54
0.2333	0.54
-0.2500	0.54
0.2666	0.54
0.2833	0.54
-0.3000	0.54
0.3166	0.54
0.3333	0.54
0.4167	0.50
-0.5000	0.50
0.5833	0.50
0.6667	0.50
-0.7500	0.50
0.8333	0.50
0.9167	0.50
-1.0000	0.50
1.0833	0.50
1.1667	0.50
-1.2500	0.50
1.3333	0.50
1.4166	0.47
-1.5000	0.50
1.5833	0.47
1.6667	0.50
-1.7500	0.50
1.8333	0.50
1.9167	0.50
-2.0000	0.50
-2.5000	0.47
-3.0000	0.47
-3.5000	0.47
-4.0000	0.47
-4.5000	0.47
-5.0000	0.44
-5.5000	0.47
-6.0000	0.47
-6.5000	0.44
-7.0000	0.47
-7.5000	0.44
-8.0000	0.47
-8.5000	0.44
-9.0000	0.44
-9.5000	0.44
-10.0000	0.47
-12.0000	0.47
-14.0000	0.47
-16.0000	0.44
-18.0000	0.44

END

Unit# 00000 Test# 4
FALLING M-07
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/29 10:10

Elapsed Time	Value
0.0000	- 0.85
-0.0033	- 0.69
0.0066	- 0.50
0.0099	- 0.44
0.0133	- 0.57
0.0166	- 0.25
-0.0200	- 0.22
0.0233	- 0.38
0.0266	- 0.34
-0.0300	- 0.28
0.0333	0.12
-0.0500	0.03
0.0666	0.28
0.0833	0.06
-0.1000	0.00
0.1166	- 0.03
0.1333	0.00
-0.1500	0.09
0.1666	0.06
0.1833	0.06
-0.2000	0.06
0.2166	0.06
0.2333	0.06
-0.2500	0.06
0.2666	0.06
0.2833	0.06
-0.3000	0.06
0.3166	0.06
0.3333	0.06
0.4167	0.06
-0.5000	0.06
0.5833	0.06
0.6667	0.06
-0.7500	0.06
0.8333	0.06
0.9167	- 0.03
-1.0000	0.09
1.0833	0.00
1.1667	0.09
-1.2500	0.06
1.3333	0.06
1.4166	0.06
-1.5000	0.06
1.5833	0.06
1.6667	0.06
-1.7500	0.06
1.8333	0.06
1.9167	0.09
-2.0000	0.09
-2.5000	0.06
-3.0000	0.06
-3.5000	0.06
-4.0000	0.06
-4.5000	0.09
-5.0000	0.09
-5.5000	0.06
-6.0000	0.06
-6.5000	0.09
-7.0000	0.06
-7.5000	0.00
-8.0000	0.09
-8.5000	0.06
-9.0000	0.06
-9.5000	0.06
-10.0000	0.06
-12.0000	0.06

END

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Unit# 00000 Test# 5
RISING HEAD m-08
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/23 12:37

Elapsed Time	Value
0.0000	0.98
0.0033	0.60
0.0066	0.92
0.0099	0.73
0.0133	1.58
0.0166	1.78
0.0200	1.93
0.0233	2.22
0.0266	2.35
0.0300	2.25
0.0333	2.16
0.0500	1.84
0.0666	1.56
0.0833	1.33
0.1000	1.11
0.1166	0.95
0.1333	0.79
0.1500	0.66
0.1666	0.57
0.1833	0.47
0.2000	0.38
0.2166	0.34
0.2333	0.28
0.2500	0.22
0.2666	0.15
0.2833	0.12
0.3000	0.09
0.3166	0.09
0.3333	0.06
0.4167	0.03
0.5000	0.00
0.5833	0.00
0.6667	-0.03
0.7500	-0.03
0.8333	0.00
0.9167	0.00
1.0000	-0.03
1.0833	-0.03
1.1667	-0.03
1.2500	-0.03
1.3333	-0.03
1.4166	-0.03
1.5000	-0.03
1.5833	0.00
1.6667	0.00
1.7500	-0.03
1.8333	-0.03
1.9167	-0.03
2.0000	-0.03
2.5000	-0.03
3.0000	-0.03
3.5000	0.00
4.0000	0.00
4.5000	-0.03
5.0000	-0.03
5.5000	-0.03
6.0000	-0.03
6.5000	-0.03
7.0000	0.00
7.5000	-0.03
8.0000	0.00
8.5000	-0.03
9.0000	0.00
9.5000	-0.03
10.0000	0.00
12.0000	3.01
14.0000	21.93

END

Unit# 00000 Test# 4
FALLING HEAD m-08
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/23 12:18

Elapsed Time	Value
0.0000	-1.39
0.0033	-1.33
0.0066	-0.60
0.0099	0.44
0.0133	-0.34
0.0166	-1.11
0.0200	-0.60
0.0233	-0.44
0.0266	-0.60
0.0300	-0.57
0.0333	-0.54
0.0500	-0.47
0.0666	-0.41
0.0833	-0.38
0.1000	-0.34
0.1166	-0.31
0.1333	-0.28
0.1500	-0.28
0.1666	-0.25
0.1833	-0.25
0.2000	-0.22
0.2166	-0.22
0.2333	-0.19
0.2500	-0.19
0.2666	-0.19
0.2833	-0.19
0.3000	-0.15
0.3166	-0.15
0.3333	-0.15
0.4167	-0.12
0.5000	-0.12
0.5833	-0.09
0.6667	-0.09
0.7500	-0.06
0.8333	-0.06
0.9167	-0.06
1.0000	-0.06
1.0833	-0.06
1.1667	-0.03
1.2500	-0.03
1.3333	-0.03
1.4166	-0.03
1.5000	-0.03
1.5833	-0.03
1.6667	-0.03
1.7500	-0.03
1.8333	-0.03
1.9167	-0.03
2.0000	-0.03
2.5000	-0.03
3.0000	-0.03
3.5000	-0.03
4.0000	-0.03
4.5000	-0.03
5.0000	0.00
5.5000	-0.03
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	-0.03
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00
12.0000	0.00
14.0000	0.00
16.0000	0.00

END

Unit# 00001 Test# 8
RISING HEAD M-09
INPUT 1: Level (F) TOC

Reference	0.00
Scale factor	100.86
Offset	0.00

Step# 0 06/20 15:18

Elapsed Time	Value
0.0000	2.16
0.0033	2.22
0.0066	2.41
0.0099	2.51
0.0133	2.47
0.0166	2.47
0.0200	2.41
0.0233	2.38
0.0266	2.44
0.0300	2.54
0.0333	2.63
0.0500	3.08
0.0666	3.36
0.0833	3.27
0.1000	3.14
0.1166	3.01
0.1333	2.92
0.1500	2.82
0.1666	2.73
0.1833	2.67
0.2000	2.60
0.2166	2.51
0.2333	2.47
0.2500	2.41
0.2666	2.35
0.2833	2.32
0.3000	2.25
0.3166	2.22
0.3333	2.19
0.4167	2.03
0.5000	1.93
0.5833	1.87
0.6667	1.84
0.7500	1.81
0.8333	1.78
0.9167	1.78
1.0000	1.78
1.0833	1.78
1.1667	1.78
1.2500	1.74
1.3333	1.74
1.4166	1.74
1.5000	1.74
1.5833	1.74
1.6667	1.74
1.7500	1.74
1.8333	1.74
1.9167	1.74
2.0000	1.74
2.5000	1.74
3.0000	1.74
3.5000	1.74
4.0000	1.74
4.5000	1.74
5.0000	1.74
5.5000	1.74
6.0000	1.74
6.5000	1.74
7.0000	1.74
7.5000	1.74
8.0000	1.74
8.5000	1.74
9.0000	1.74
9.5000	1.74
10.0000	1.74

END

Unit# 00001 Test# 8
FALLING HEAD M-09
INPUT 1: Level (F) TOC

Reference	0.00
Scale factor	100.86
Offset	0.00

Step# 0 06/20 14:58

Elapsed Time	Value
0.0000	- 1.62
0.0033	- 1.62
0.0066	- 1.17
0.0099	- 1.01
0.0133	- 1.23
0.0166	- 1.11
0.0200	- 1.01
0.0233	- 1.04
0.0266	- 0.98
0.0300	- 0.95
0.0333	- 0.92
0.0500	- 0.82
0.0666	- 0.73
0.0833	- 0.63
0.1000	- 0.54
0.1166	- 0.47
0.1333	- 0.44
0.1500	- 0.38
0.1666	- 0.34
0.1833	- 0.31
0.2000	- 0.31
0.2166	- 0.28
0.2333	- 0.25
0.2500	- 0.22
0.2666	- 0.22
0.2833	- 0.22
0.3000	- 0.19
0.3166	- 0.19
0.3333	- 0.19
0.4167	- 0.15
0.5000	- 0.12
0.5833	- 0.12
0.6667	- 0.09
0.7500	- 0.09
0.8333	- 0.09
0.9167	- 0.09
1.0000	- 0.09
1.0833	- 0.09
1.1667	- 0.09
1.2500	- 0.06
1.3333	- 0.06
1.4166	- 0.06
1.5000	- 0.06
1.5833	- 0.06
1.6667	- 0.06
1.7500	- 0.06
1.8333	- 0.06
1.9167	- 0.06
2.0000	- 0.06
2.5000	- 0.06
3.0000	- 0.06
3.5000	- 0.03
4.0000	- 0.03
4.5000	- 0.03
5.0000	- 0.03
5.5000	- 0.03
[illegible]	[illegible]

FALLING HEAD M-10

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/20 12:51

Elapsed Time	Value
0.0000	- 3.08
0.0033	- 2.63
0.0066	- 0.60
0.0099	- 1.52
0.0133	- 0.28
0.0166	- 1.84
0.0200	- 1.84
0.0233	- 1.01
0.0266	- 1.46
0.0300	- 1.49
0.0333	- 1.17
0.0500	- 1.23
0.0666	- 1.14
0.0833	- 1.08
0.1000	- 1.04
0.1166	- 0.98
0.1333	- 0.95
0.1500	- 0.92
0.1666	- 0.92
0.1833	- 0.89
0.2000	- 0.89
0.2166	- 0.89
0.2333	- 0.85
0.2500	- 0.85
0.2666	- 0.82
0.2833	- 0.82
0.3000	- 0.82
0.3166	- 0.82
0.3333	- 0.82
0.4167	- 0.82
0.5000	- 0.79
0.5833	- 0.79
0.6667	- 0.76
0.7500	- 0.79
0.8333	- 0.79
0.9167	- 0.76
1.0000	- 0.76
1.0833	- 0.76
1.1667	- 0.76
1.2500	- 0.73
1.3333	- 0.73
1.4166	- 0.76
1.5000	- 0.73
1.5833	- 0.73
1.6667	- 0.73
1.7500	- 0.73
1.8333	- 0.73
1.9167	- 0.73
2.0000	- 0.73
2.5000	- 0.73
3.0000	- 0.73
3.5000	- 0.69
4.0000	- 0.69
4.5000	- 0.66
5.0000	- 0.63
5.5000	- 0.63
6.0000	- 0.60
6.5000	- 0.63
7.0000	- 0.60
7.5000	- 0.57
8.0000	- 0.57
8.5000	- 0.57
9.0000	- 0.54
9.5000	- 0.54
10.0000	- 0.50
12.0000	- 0.47
14.0000	- 0.44
16.0000	- 0.41
18.0000	- 0.38
20.0000	- 0.31
22.0000	- 0.25

RISING HEAD M-10

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/20 13:16

Elapsed Time	Value
0.0000	2.63
0.0033	2.76
0.0066	2.82
0.0099	2.76
0.0133	2.70
0.0166	2.67
- 0.0200	2.67
0.0233	2.63
0.0266	2.60
- 0.0300	2.57
0.0333	2.54
- 0.0500	2.41
0.0666	2.35
0.0833	2.25
- 0.1000	2.12
0.1166	2.03
0.1333	1.93
- 0.1500	1.84
0.1666	1.74
0.1833	1.68
0.2000	1.65
0.2166	1.58
0.2333	1.55
0.2500	1.49
0.2666	1.46
0.2833	1.39
0.3000	1.36
0.3166	1.36
0.3333	1.33
0.4167	1.27
0.5000	1.20
0.5833	1.14
0.6667	1.14
- 0.7500	1.14
0.8333	1.14
0.9167	1.14
- 1.0000	1.11
1.0833	1.08
1.1667	1.08
1.2500	1.08
1.3333	1.08
1.4166	1.08
1.5000	1.04
1.5833	1.04
1.6667	1.04
1.7500	1.08
1.8333	1.08
1.9167	1.08
2.0000	1.04
2.5000	1.01
3.0000	1.01
3.5000	1.01
4.0000	1.01
4.5000	1.04
5.0000	0.98
5.5000	0.95
6.0000	1.04
6.5000	1.01
7.0000	1.01
7.5000	0.92
8.0000	0.98
8.5000	0.98
9.0000	0.98
9.5000	0.95
10.0000	0.92
12.0000	0.92

END

Unit# 00000 Test# 3
RISING M-11
INPUT 1: Level (F) TOC

Reference	0.00
Scale factor	100.86
Offset	0.00

Step# 0 06/29 09:15

Elapsed Time	Value
0.0000	1.71
0.0033	1.81
0.0066	1.90
0.0099	1.90
0.0133	1.97
0.0166	2.12
0.0200	2.09
0.0233	2.16
0.0266	2.35
0.0300	2.41
0.0333	2.51
0.0500	2.67
0.0666	2.63
0.0833	2.60
0.1000	2.60
0.1166	2.57
0.1333	2.54
0.1500	2.54
0.1666	2.54
0.1833	2.51
0.2000	2.47
0.2166	2.47
0.2333	2.44
0.2500	2.44
0.2666	2.41
0.2833	2.41
0.3000	2.38
0.3166	2.38
0.3333	2.38
0.4167	2.28
0.5000	2.22
0.5833	2.16
0.6667	2.12
0.7500	2.06
0.8333	2.03
0.9167	1.97
1.0000	1.93
1.0833	1.90
1.1667	1.84
1.2500	1.81
1.3333	1.78
1.4166	1.74
1.5000	1.71
1.5833	1.68
1.6667	1.65
1.7500	1.62
1.8333	1.62
1.9167	1.58
2.0000	1.55
2.5000	1.46
3.0000	1.39
3.5000	1.36
4.0000	1.33
4.5000	1.30
5.0000	1.27
5.5000	1.27
6.0000	1.23
6.5000	1.20
7.0000	1.20
7.5000	1.17
8.0000	1.14
8.5000	1.14
9.0000	1.11
9.5000	1.11
10.0000	1.08
12.0000	1.01

END

Unit#.00000 Test# 2
FALLING M-11
INPUT 1: Level (F) TOC

Reference	0.00
Scale factor	100.86
Offset	0.00

Step# 0 06/29 09:00

Elapsed Time	Value
0.0000	- 1.49
0.0033	- 2.22
0.0066	- 2.60
0.0099	- 2.92
0.0133	- 2.47
0.0166	- 2.00
0.0200	- 1.11
0.0233	- 1.90
0.0266	- 2.25
0.0300	- 2.32
0.0333	- 2.32
0.0500	- 2.25
0.0666	- 2.19
0.0833	- 1.90
0.1000	- 1.81
0.1166	- 2.03
0.1333	- 2.12
0.1500	- 1.78
0.1666	- 1.87
0.1833	- 1.84
0.2000	- 1.84
0.2166	- 1.81
0.2333	- 1.81
0.2500	- 1.78
0.2666	- 1.74
0.2833	- 1.74
0.3000	- 1.74
0.3166	- 1.71
0.3333	- 1.68
0.4167	- 1.65
0.5000	- 1.58
0.5833	- 1.52
0.6667	- 1.46
0.7500	- 1.43
0.8333	- 1.36
0.9167	- 1.30
1.0000	- 1.27
1.0833	- 1.23
1.1667	- 1.17
1.2500	- 1.14
1.3333	- 1.11
1.4166	- 1.08
1.5000	- 1.04
1.5833	- 1.01
1.6667	- 0.98
1.7500	- 0.95
1.8333	- 0.92
1.9167	- 0.92
2.0000	- 0.89
2.5000	- 0.76
3.0000	- 0.66
3.5000	- 0.57
4.0000	- 0.50
4.5000	- 0.44
5.0000	- 0.38
5.5000	- 0.31
6.0000	- 0.28
6.5000	- 0.25
7.0000	- 0.22
7.5000	- 0.19
8.0000	- 0.15
8.5000	- 0.12
9.0000	- 0.12
9.5000	- 0.09
10.0000	- 0.06

Unit# 00000 Test# 9

RISING M-12

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/29 13:57

Elapsed Time	Value
0.0000	1.04
0.0033	0.79
0.0066	0.76
0.0099	0.79
0.0133	0.76
0.0166	0.73
-0.0200	0.73
0.0233	0.69
0.0266	0.66
-0.0300	0.66
0.0333	0.63
-0.0500	0.54
0.0666	0.47
0.0833	0.41
-0.1000	0.34
0.1166	0.31
0.1333	0.28
-0.1500	0.25
0.1666	0.25
0.1833	0.22
-0.2000	0.19
0.2166	0.19
0.2333	0.15
-0.2500	0.15
0.2666	0.15
0.2833	0.12
-0.3000	0.12
0.3166	0.12
0.3333	0.12
0.4167	0.09
-0.5000	0.06
0.5833	0.06
0.6667	0.06
-0.7500	0.06
0.8333	0.06
0.9167	0.06
-1.0000	0.06
1.0833	0.03
1.1667	0.03
-1.2500	0.03
1.3333	0.03
1.4166	0.06
-1.5000	0.03
1.5833	0.03
1.6667	0.03
-1.7500	0.03
1.8333	0.03
1.9167	0.03
-2.0000	0.03
-2.5000	0.03
-3.0000	0.03
-3.5000	0.00
-4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.00

END

FALLING M-12

INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/29 13:45

Elapsed Time	Value
0.0000	0.98
-0.0033	0.85
0.0066	1.08
0.0099	0.66
0.0133	0.63
0.0166	0.19
-0.0200	0.44
0.0233	0.34
0.0266	0.31
-0.0300	0.28
0.0333	0.31
-0.0500	0.28
0.0666	0.22
0.0833	0.19
-0.1000	0.19
0.1166	0.19
0.1333	0.15
-0.1500	0.15
0.1666	0.15
0.1833	0.12
-0.2000	0.12
0.2166	0.12
0.2333	0.12
-0.2500	0.12
0.2666	0.12
0.2833	0.12
-0.3000	0.12
0.3166	0.09
0.3333	0.09
0.4167	0.09
-0.5000	0.09
0.5833	0.09
0.6667	0.09
-0.7500	0.06
0.8333	0.06
0.9167	0.06
-1.0000	0.06
1.0833	0.06
1.1667	0.06
-1.2500	0.06
1.3333	0.03
1.4166	0.03
-1.5000	0.03
1.5833	0.03
1.6667	0.03
-1.7500	0.03
1.8333	0.03
1.9167	0.03
-2.0000	0.03
-2.5000	0.03
-3.0000	0.03
-3.5000	0.00
-4.0000	0.00
4.5000	0.00
5.0000	0.00
5.5000	0.00
6.0000	0.00
6.5000	0.00
7.0000	0.00
7.5000	0.00
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	0.03

END

Unit# 00000 Test# 8
RISING HEAD M-13
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/23 15:12

Elapsed Time	Value
0.0000	1.58
0.0033	1.27
0.0066	0.44
0.0099	0.60
0.0133	0.66
0.0166	1.08
0.0200	1.62
0.0233	1.81
0.0266	2.00
0.0300	2.09
0.0333	2.35
0.0500	1.97
0.0666	1.71
0.0833	1.52
0.1000	1.55
0.1166	1.27
0.1333	1.08
0.1500	0.95
0.1666	0.82
0.1833	0.73
0.2000	0.63
0.2166	0.57
0.2333	0.50
0.2500	0.44
0.2666	0.38
0.2833	0.34
0.3000	0.31
0.3166	0.25
0.3333	0.25
0.4167	0.12
0.5000	0.09
0.5833	0.06
0.6667	0.06
0.7500	0.06
0.8333	0.06
0.9167	0.06
1.0000	0.06
1.0833	0.06
1.1667	0.06
1.2500	0.06
1.3333	0.06
1.4166	0.06
1.5000	0.06
1.5833	0.06
1.6667	0.06
1.7500	0.06
1.8333	0.06
1.9167	0.06
2.0000	0.06
2.5000	0.03
3.0000	0.06
3.5000	0.06
4.0000	0.06
4.5000	0.06
5.0000	0.03
5.5000	0.06
6.0000	0.06
6.5000	0.06
7.0000	0.03
7.5000	0.06
8.0000	0.03
8.5000	0.03
9.0000	0.03
9.5000	0.03
10.0000	0.06

END

Unit# 00000 Test# 8
FALLING HEAD M-13
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/23 14:56

Elapsed Time	Value
0.0000	- 0.92
0.0033	- 1.11
0.0066	- 1.30
0.0099	- 1.49
0.0133	- 1.55
0.0166	- 1.27
0.0200	- 1.74
0.0233	- 2.06
0.0266	- 1.93
0.0300	- 1.93
0.0333	- 1.78
0.0500	- 1.27
0.0666	- 1.17
0.0833	- 0.89
0.1000	- 0.76
0.1166	- 0.66
0.1333	- 0.57
0.1500	- 0.50
0.1666	- 0.44
0.1833	- 0.41
0.2000	- 0.34
0.2166	- 0.31
0.2333	- 0.25
0.2500	- 0.22
0.2666	- 0.19
0.2833	- 0.19
0.3000	- 0.15
0.3166	- 0.12
0.3333	- 0.12
0.4167	- 0.06
0.5000	- 0.03
0.5833	- 0.03
0.6667	- 0.03
0.7500	- 0.03
0.8333	- 0.03
0.9167	0.00
1.0000	0.00
1.0833	- 0.03
1.1667	- 0.03
1.2500	0.00
1.3333	0.00
1.4166	0.00
1.5000	- 0.03
1.5833	0.00
1.6667	0.00
1.7500	0.00
1.8333	- 0.03
1.9167	0.00
2.0000	0.00
2.5000	- 0.03
3.0000	- 0.03
3.5000	0.00
4.0000	- 0.03
4.5000	- 0.03
5.0000	0.00
5.5000	0.00
6.0000	- 0.03
6.5000	0.00
7.0000	0.00
7.5000	- 0.03
8.0000	0.00
8.5000	0.00
9.0000	0.00
9.5000	0.00
10.0000	- 0.03
12.0000	0.00

END

Unit# 00001 Test# 5
RISING HEAD M-14
INPUT 1: Level (F) TOC

Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/20 12:06

Elapsed Time	Value
0.0000	1.23
0.0033	1.74
0.0066	2.79
0.0099	2.67
0.0133	2.63
0.0166	2.57
0.0200	2.54
0.0233	2.47
0.0266	2.44
0.0300	2.38
0.0333	2.35
0.0500	2.09
0.0666	1.87
0.0833	1.68
0.1000	1.52
0.1166	1.39
0.1333	1.27
0.1500	1.17
0.1666	1.11
0.1833	1.08
0.2000	1.01
0.2166	0.98
0.2333	0.98
0.2500	0.95
0.2666	0.92
0.2833	0.92
0.3000	0.89
0.3166	0.89
0.3333	0.89
0.4167	0.85
0.5000	0.82
0.5833	0.82
0.6667	0.79
0.7500	0.79
0.8333	0.76
0.9167	0.76
1.0000	0.76
1.0833	0.76
1.1667	0.73
1.2500	0.76
1.3333	0.73
1.4166	0.73
1.5000	0.73
1.5833	0.73
1.6667	0.73
1.7500	0.73
1.8333	0.69
1.9167	0.69
2.0000	0.73
2.5000	0.69
3.0000	0.66
3.5000	0.66
4.0000	0.66
4.5000	0.66
5.0000	0.66
5.5000	0.66
6.0000	0.63
6.5000	0.63
7.0000	0.63
7.5000	0.63
8.0000	0.63
8.5000	0.63
9.0000	0.63
9.5000	0.63
10.0000	0.63
12.0000	0.60
14.0000	0.63

END

Unit# 00001 Test# 4
FALLING HEAD M-14
INPUT 1: Level (F) TOC

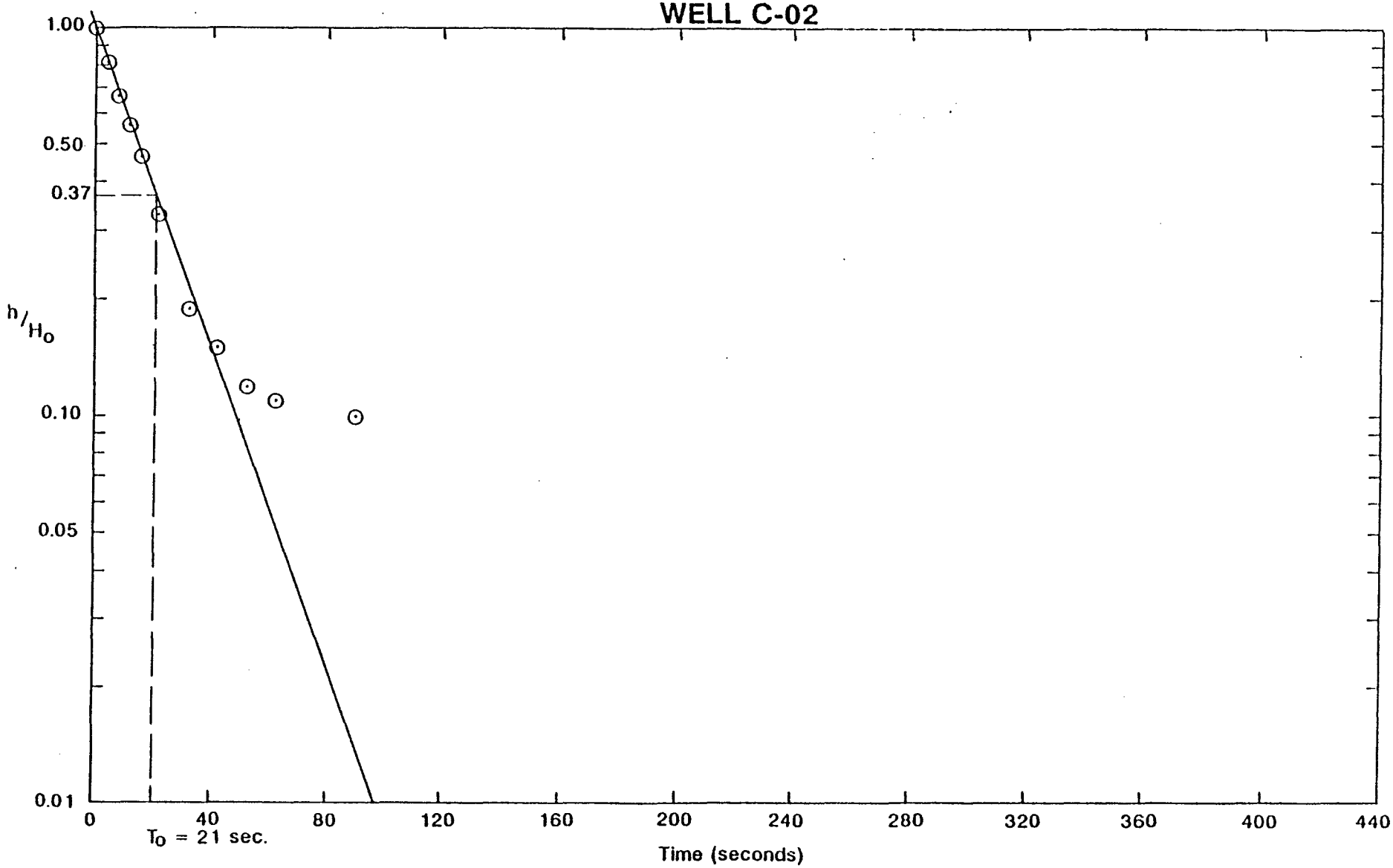
Reference 0.00
Scale factor 100.86
Offset 0.00

Step# 0 06/20 11:51

Elapsed Time	Value
0.0000	- 1.14
0.0033	0.60
0.0066	0.41
0.0099	- 1.93
0.0133	- 0.98
0.0166	- 0.47
0.0200	- 1.14
0.0233	- 0.79
0.0266	- 0.85
0.0300	- 0.89
0.0333	- 0.82
0.0500	- 0.79
0.0666	- 0.76
0.0833	- 0.76
0.1000	- 0.76
0.1166	- 0.76
0.1333	- 0.76
0.1500	- 0.76
0.1666	- 0.76
0.1833	- 0.76
0.2000	- 0.76
0.2166	- 0.76
0.2333	- 0.76
0.2500	- 0.76
0.2666	- 0.76
0.2833	- 0.76
0.3000	- 0.76
0.3166	- 0.76
0.3333	- 0.76
0.4167	- 0.76
0.5000	- 0.76
0.5833	- 0.76
0.6667	- 0.76
0.7500	- 0.76
0.8333	- 0.76
0.9167	- 0.76
1.0000	- 0.76
1.0833	- 0.73
1.1667	- 0.73
1.2500	- 0.73
1.3333	- 0.73
1.4166	- 0.73
1.5000	- 0.73
1.5833	- 0.73
1.6667	- 0.73
1.7500	- 0.73
1.8333	- 0.73
1.9167	- 0.73
2.0000	- 0.73
2.5000	- 0.69
3.0000	- 0.69
3.5000	- 0.69
4.0000	- 0.66
4.5000	- 0.66
5.0000	- 0.66
5.5000	- 0.66
6.0000	- 0.63
6.5000	- 0.63
7.0000	- 0.63
7.5000	- 0.63
8.0000	- 0.63
8.5000	- 0.60
9.0000	- 0.60
9.5000	- 0.60
10.0000	- 0.60
12.0000	- 0.60

END

RISING HEAD PERMEABILITY TEST
WELL C-02



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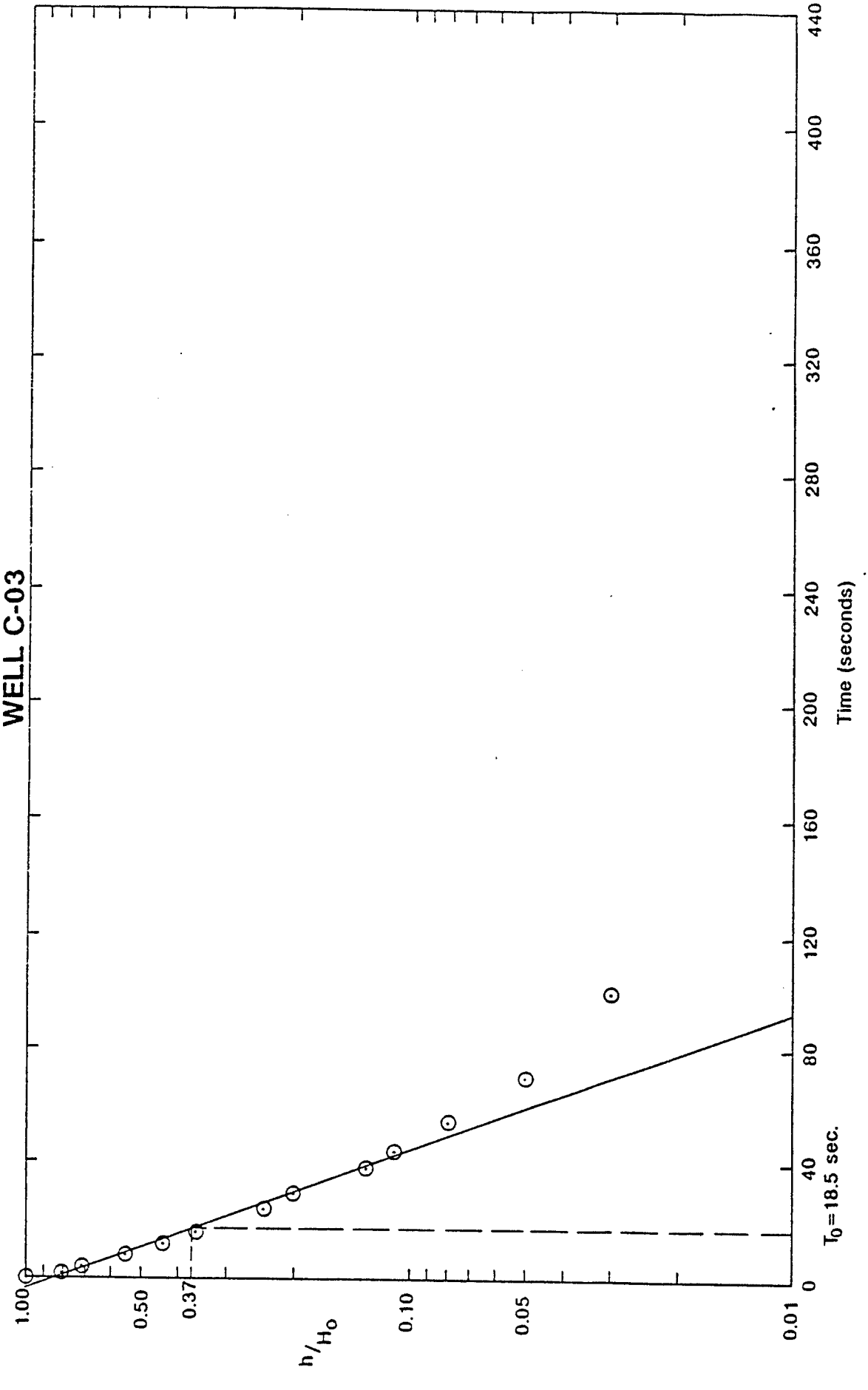
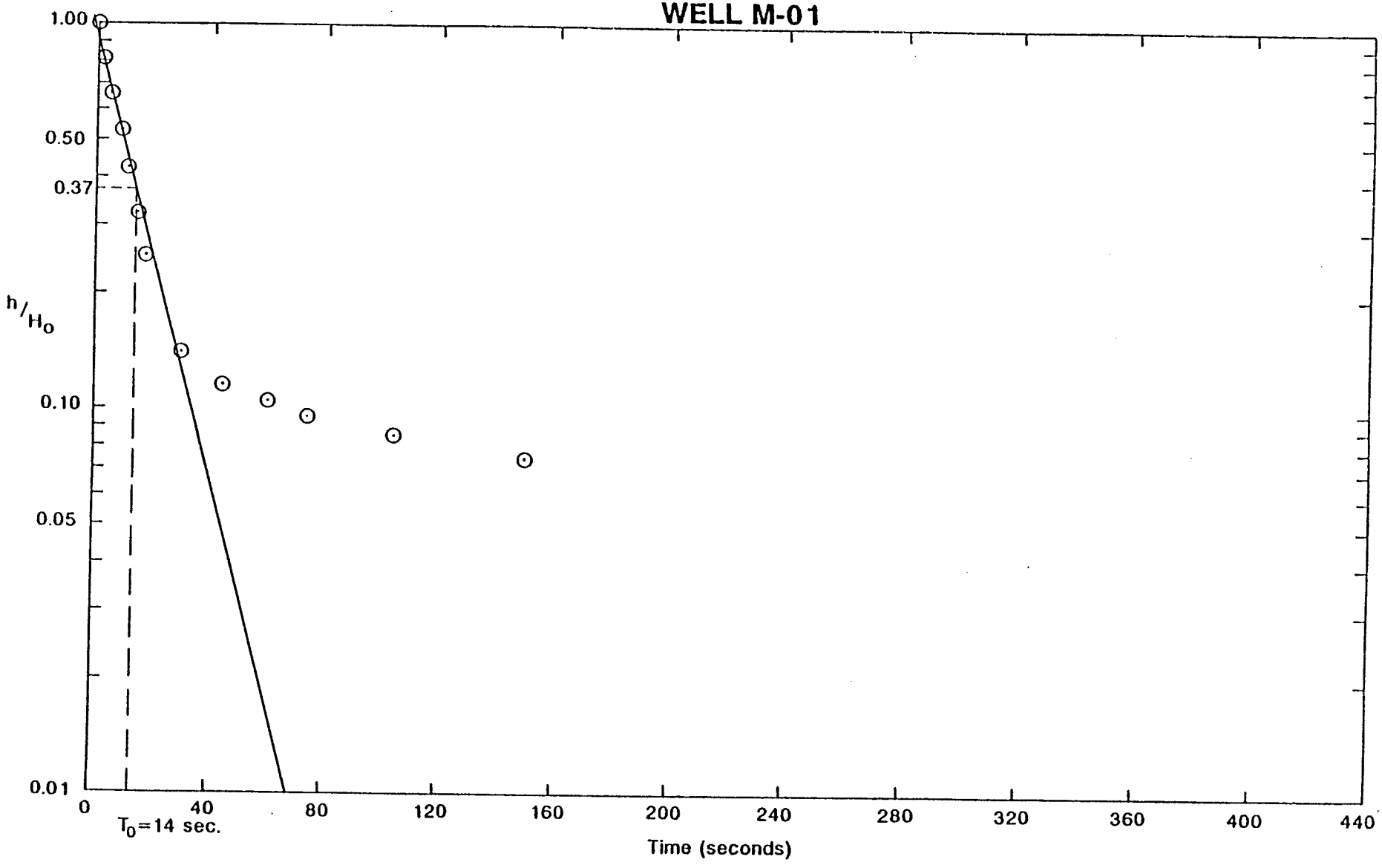
RISING HEAD PERMEABILITY TEST
WELL C-03



RISING HEAD PERMEABILITY TEST
WELL M-01



• B-3 •

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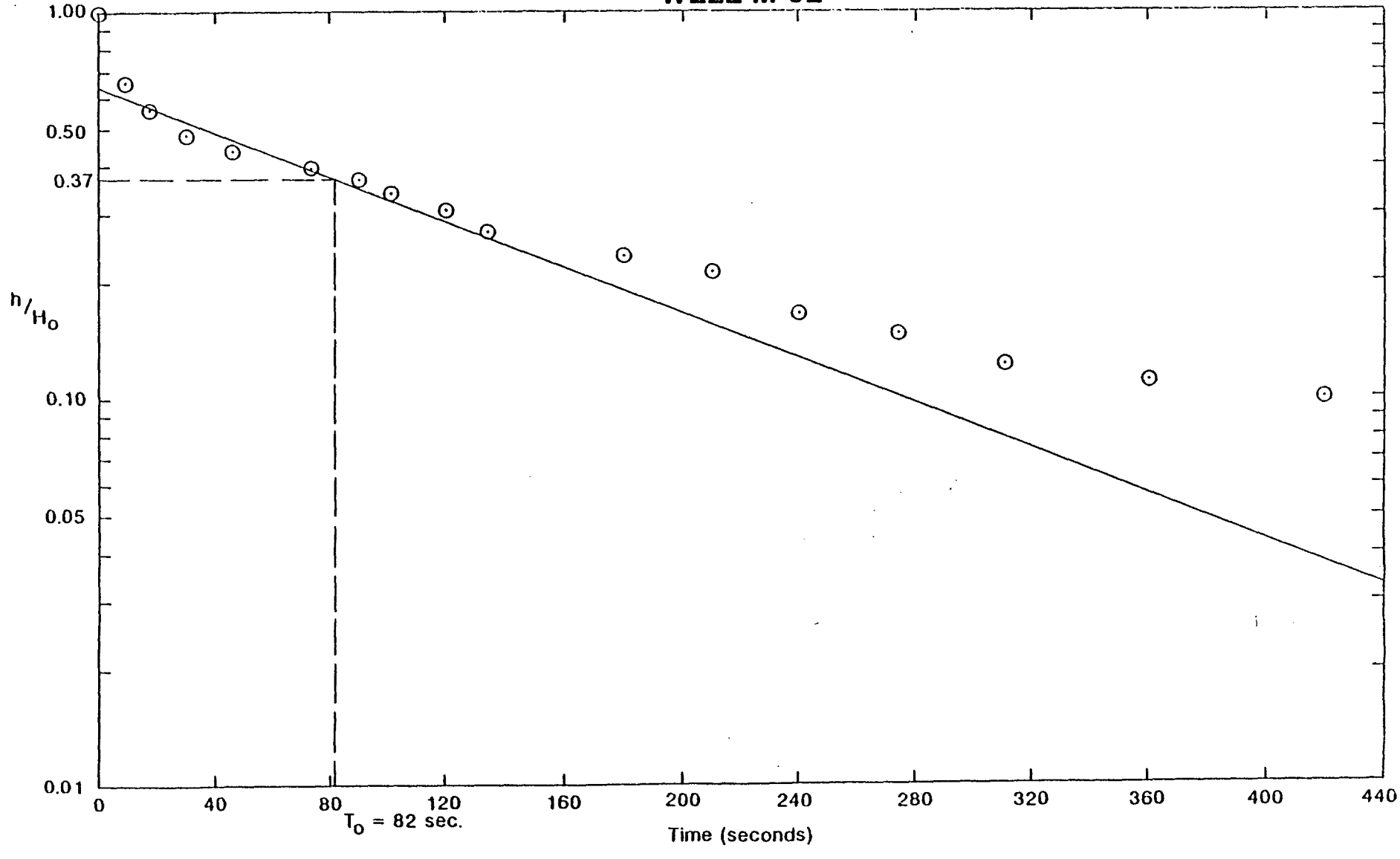
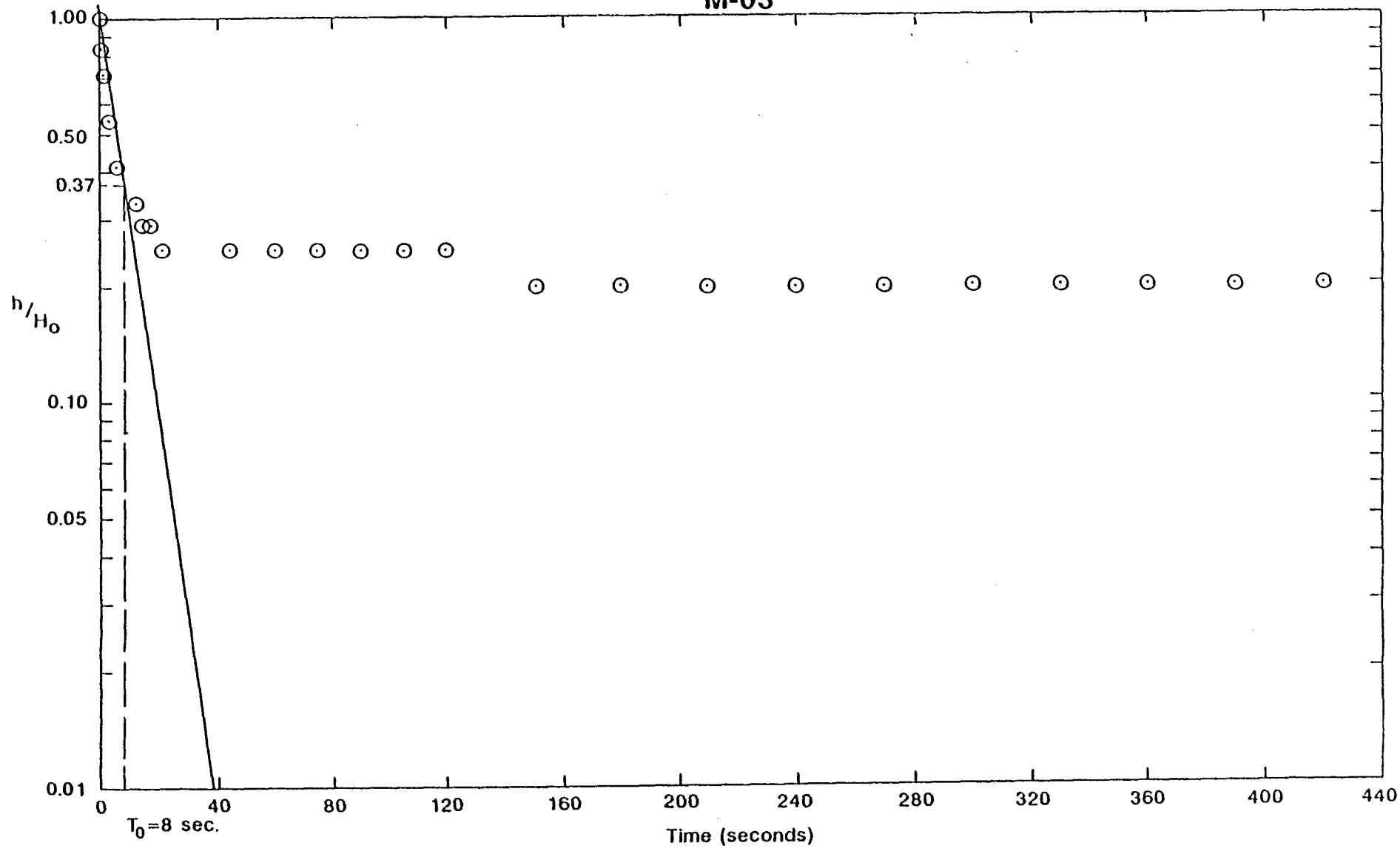
RISING HEAD PERMEABILITY TEST
WELL M-02



RISING HEAD PERMEABILITY TEST
M-03



• B-5 •

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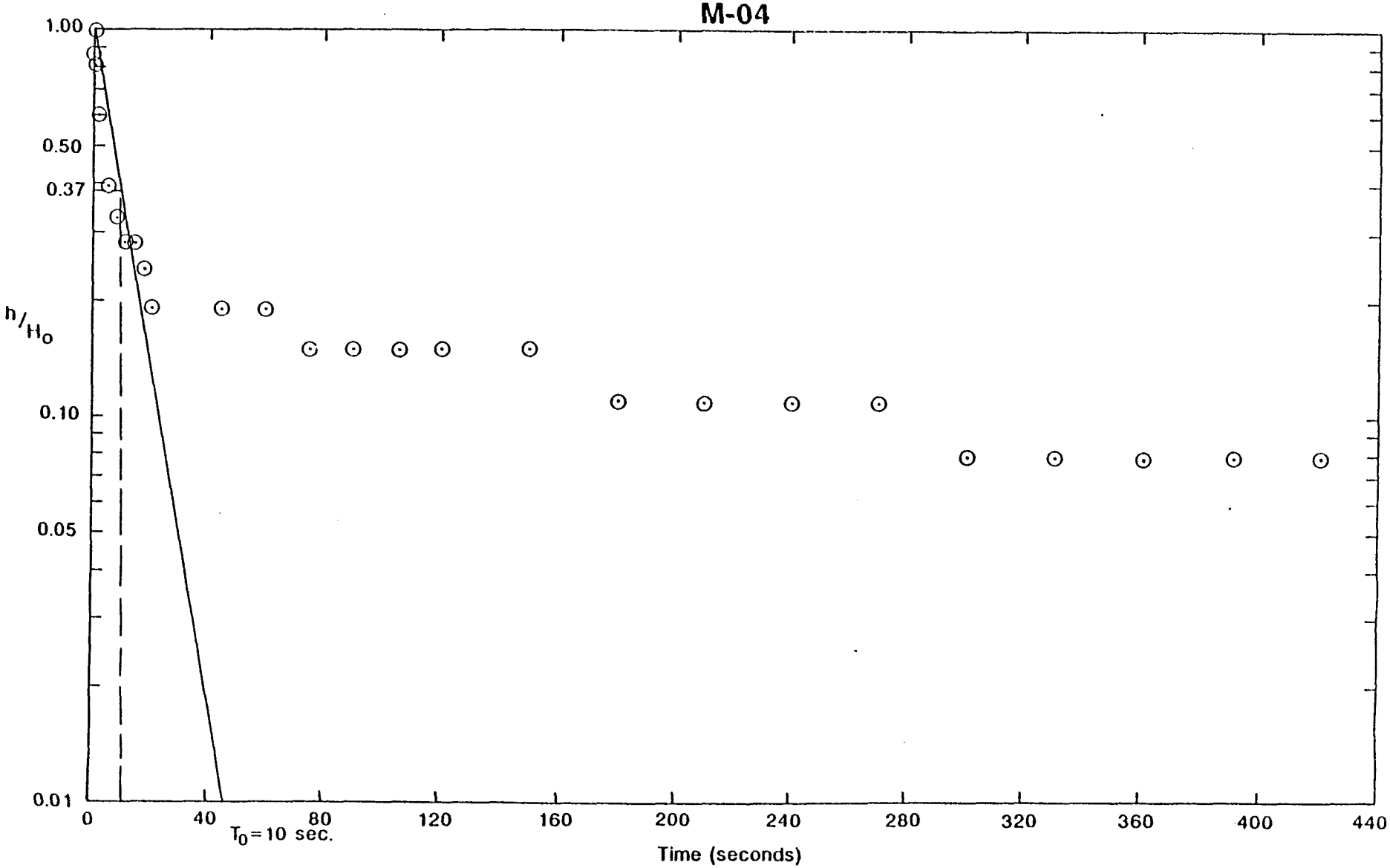
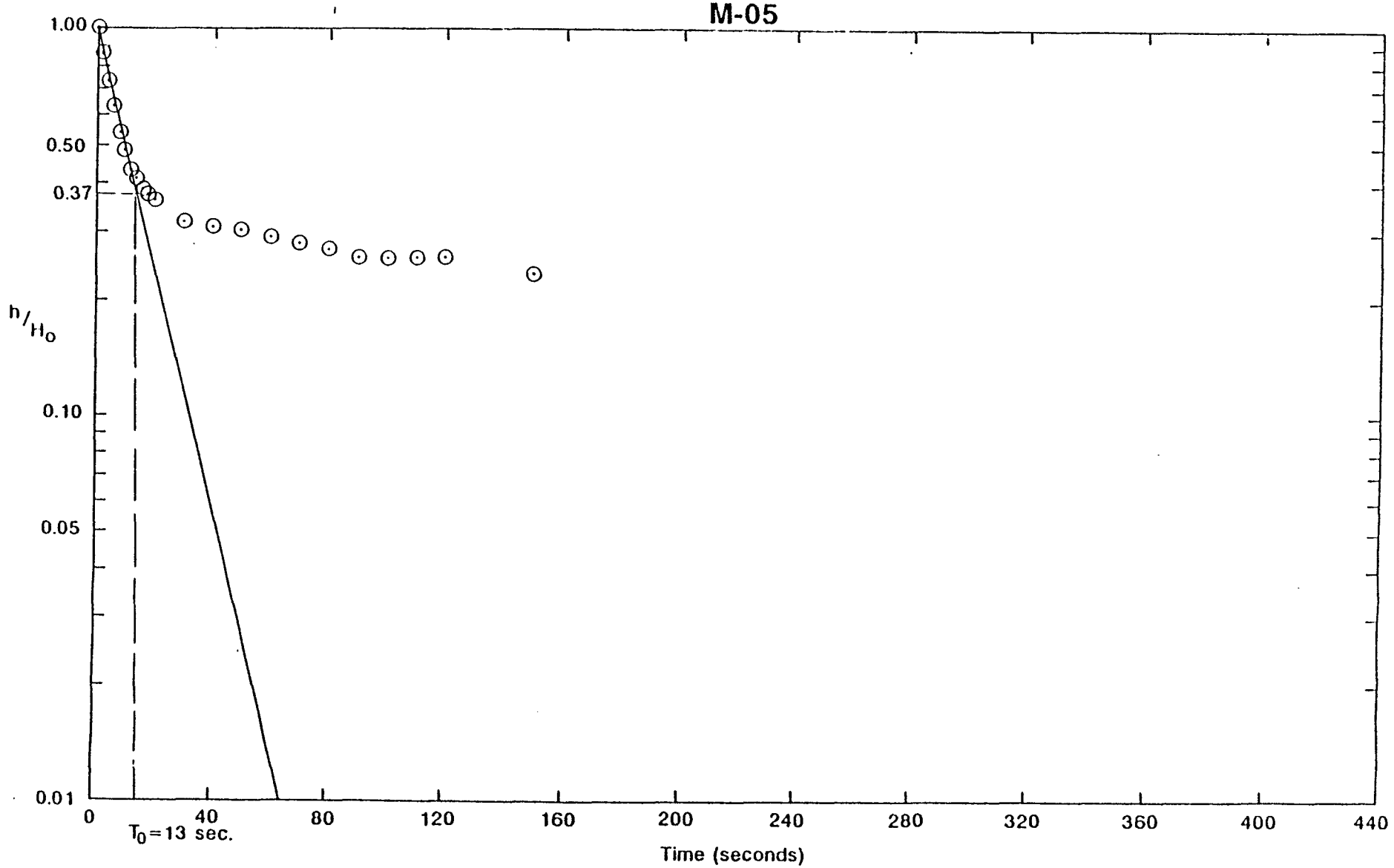
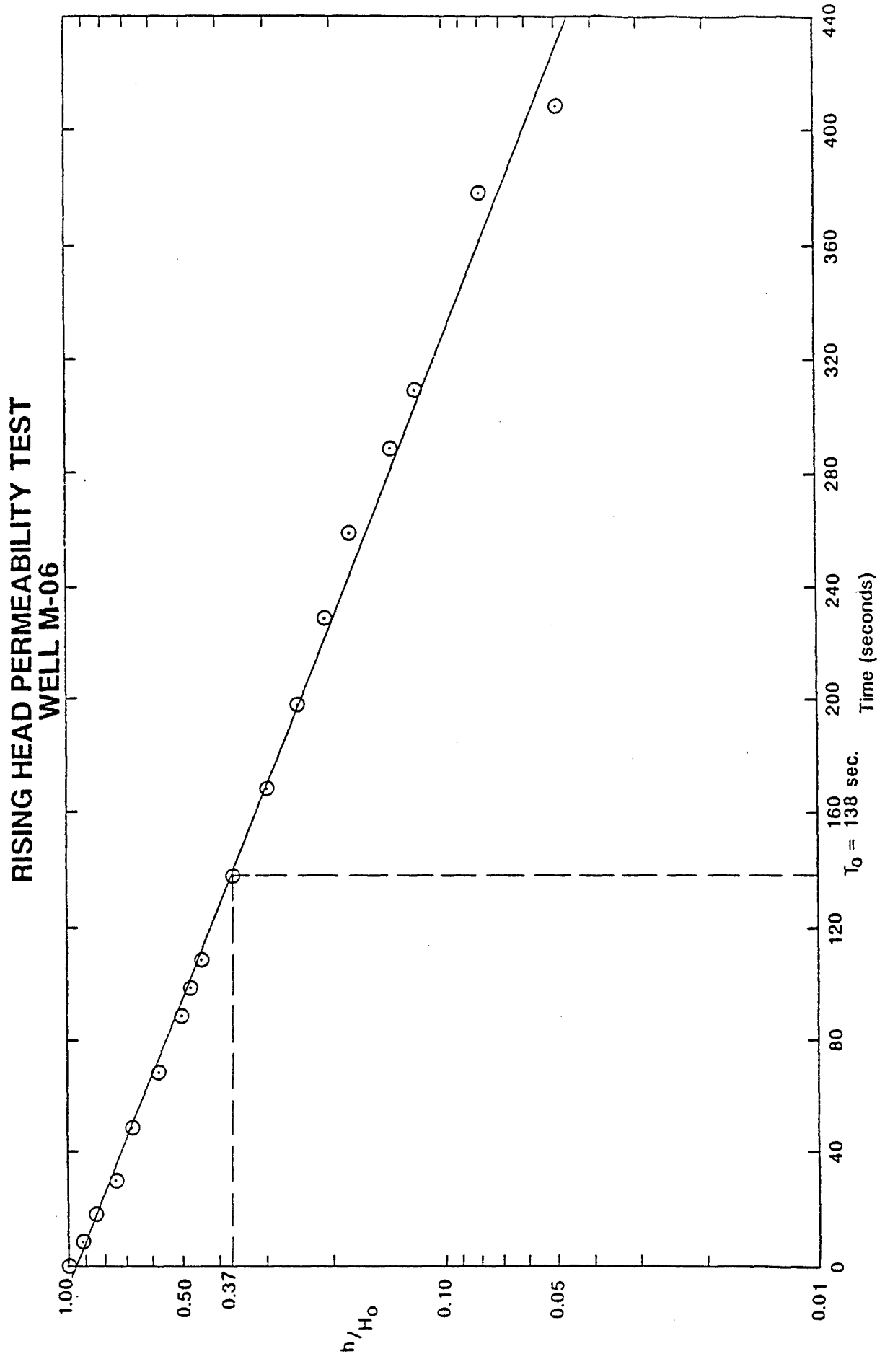
RISING HEAD PERMEABILITY TEST
M-04

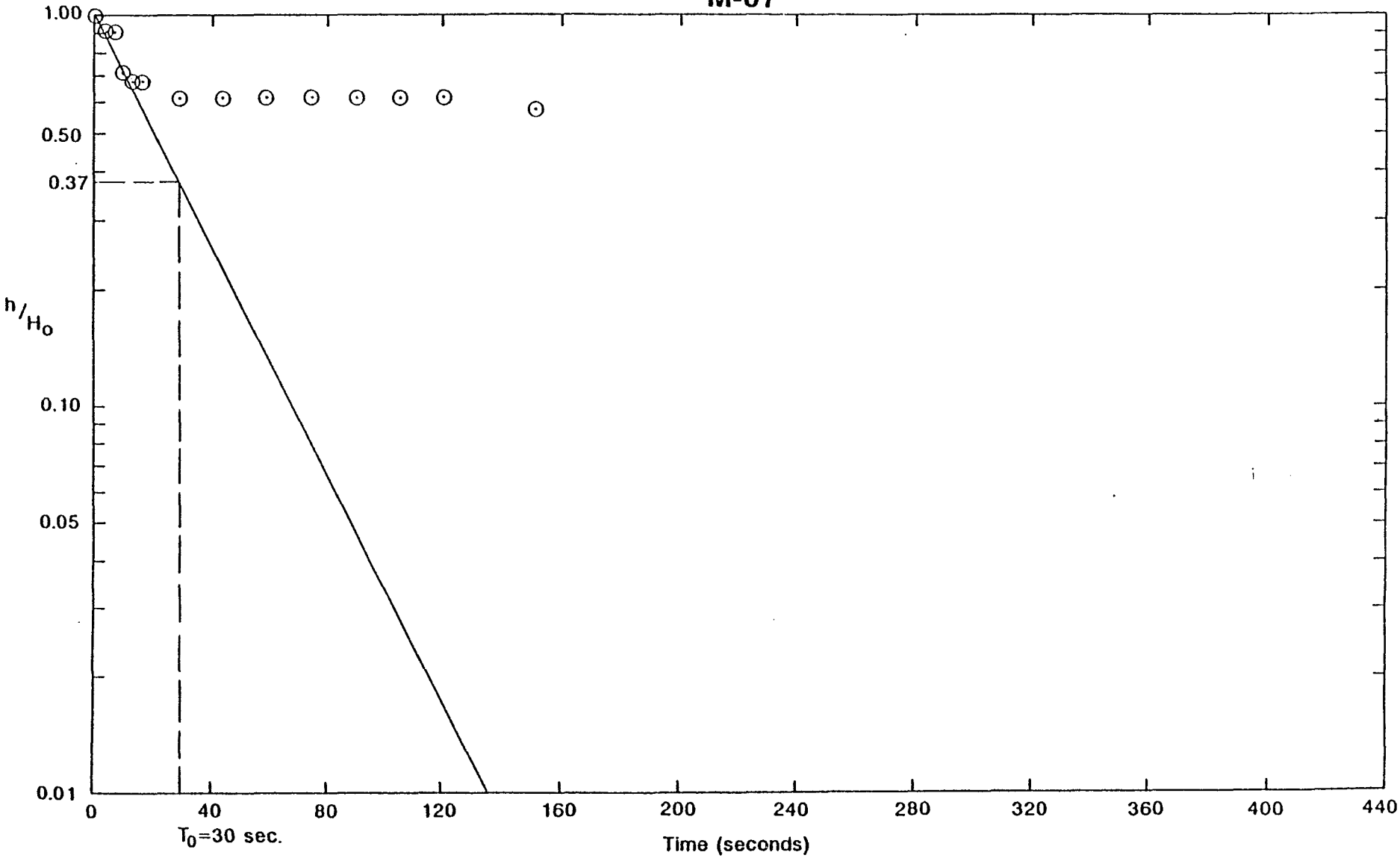


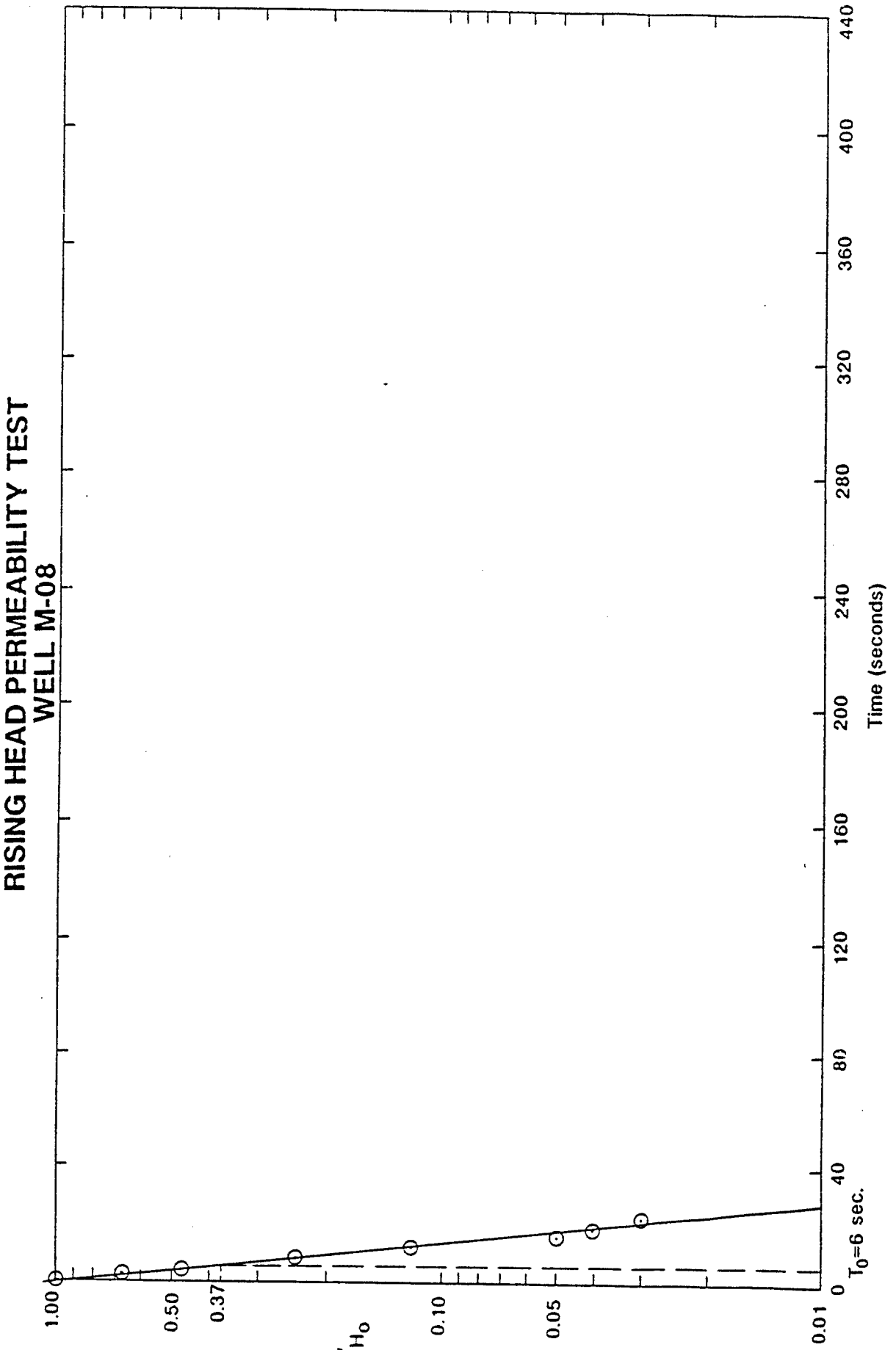
RISING HEAD PERMEABILITY TEST
M-05



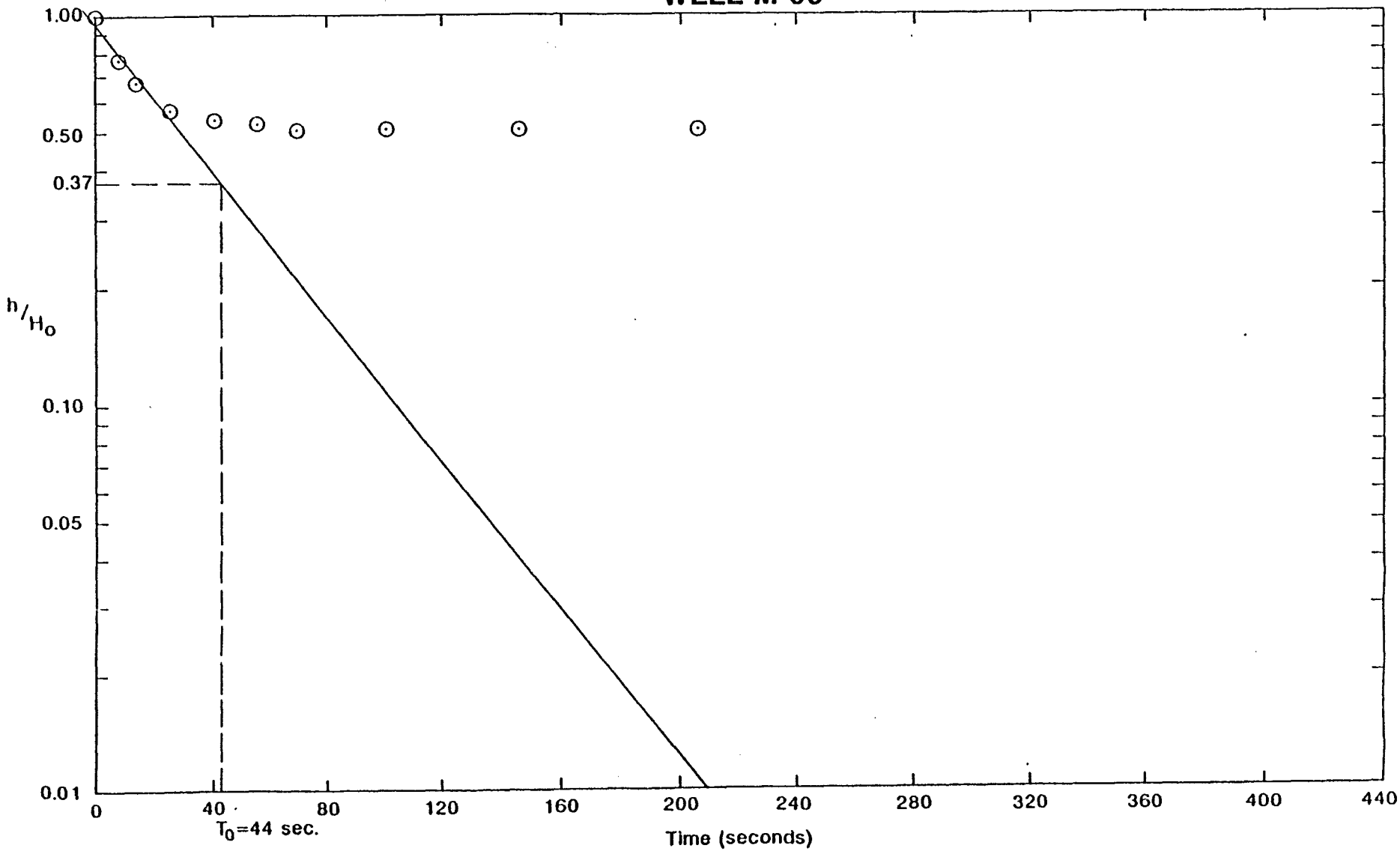

RISING HEAD PERMEABILITY TEST
WELL M-06
1.00
0.50
0.37
0.10
0.05
0.01
h/Ho
0
40
80
120
160
200
240
280
320
360
400
440
To = 138 sec.
Time (seconds)

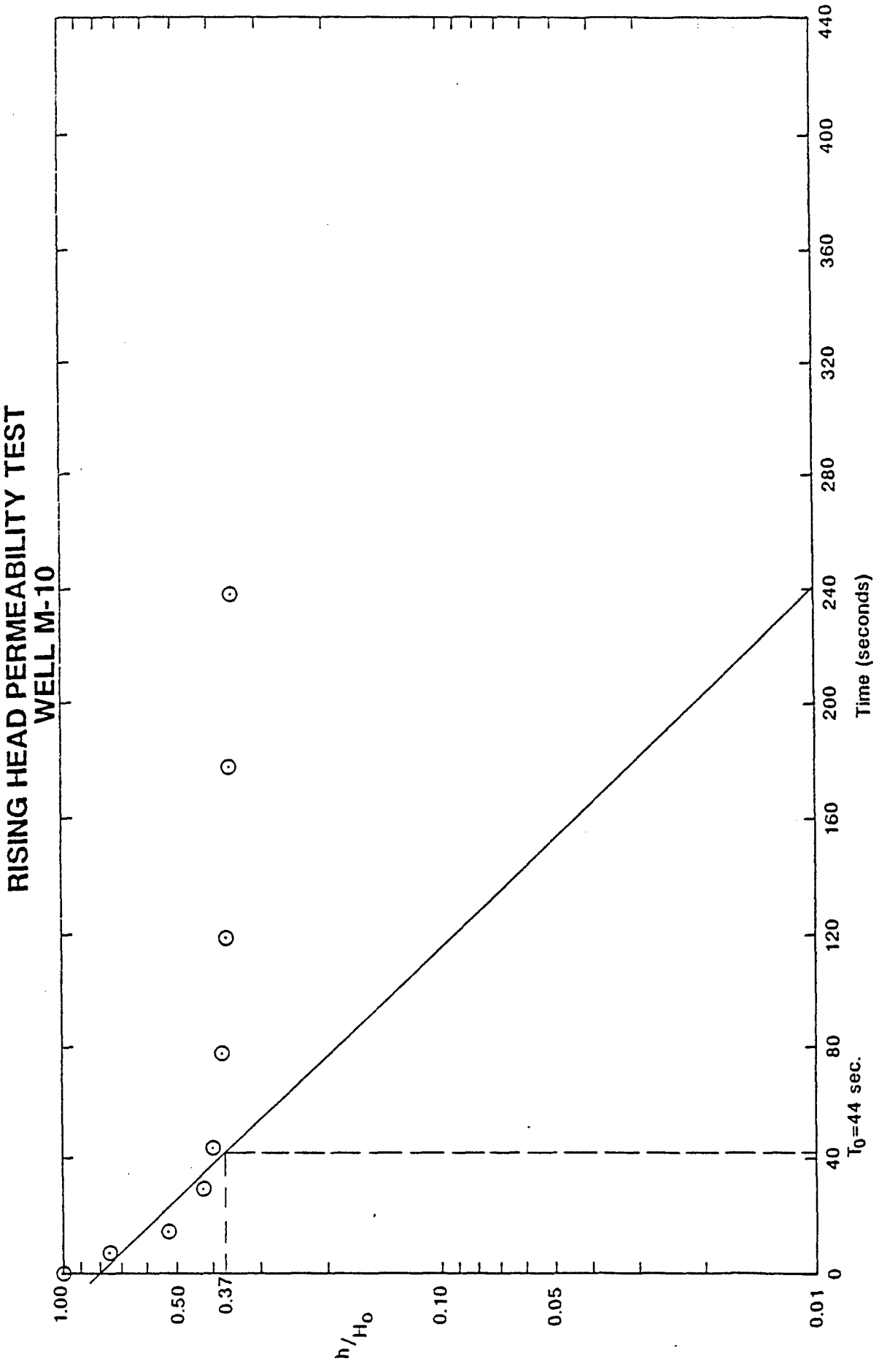
RISING HEAD PERMEABILITY TEST
M-07



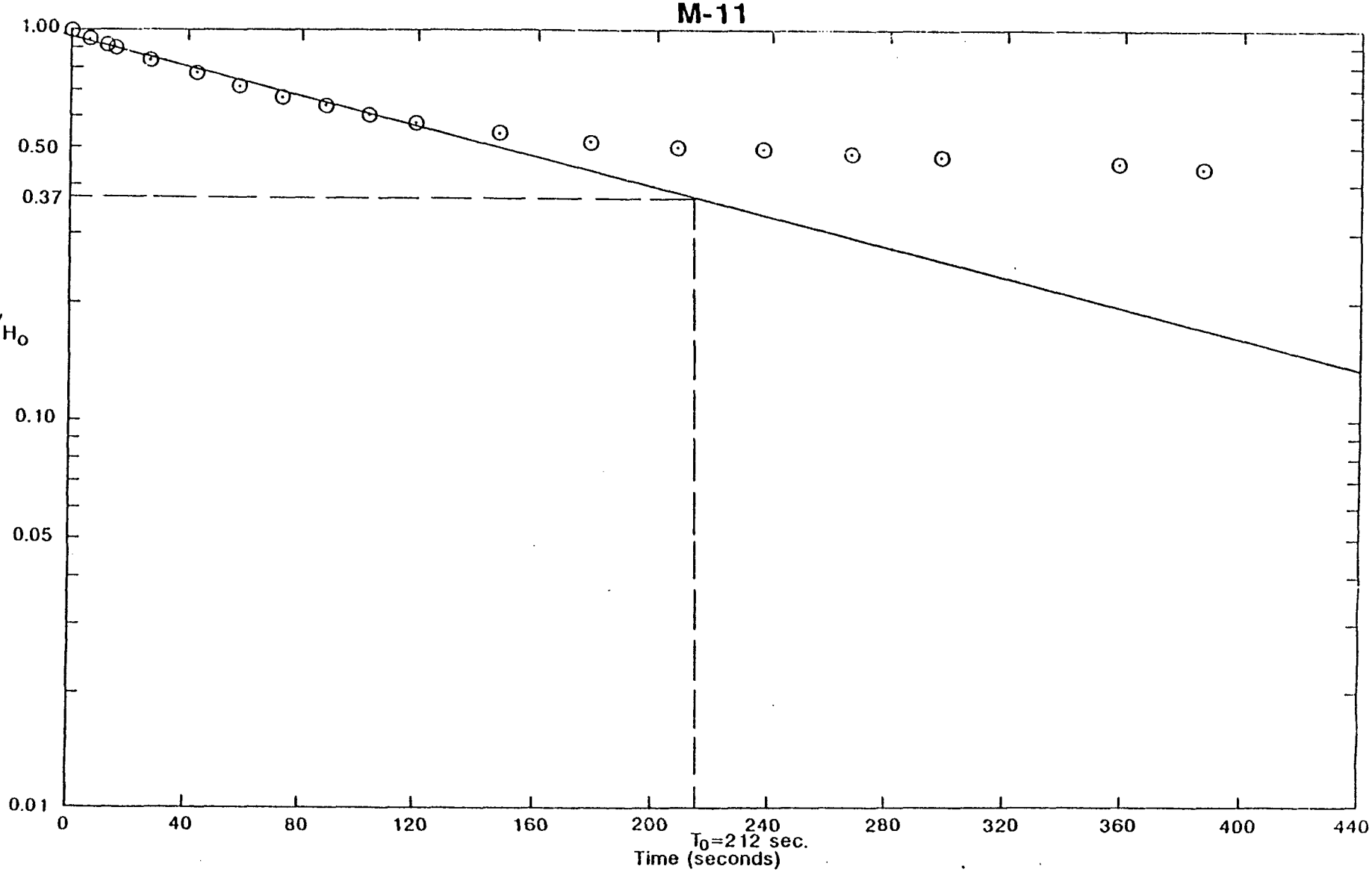

RISING HEAD PERMEABILITY TEST
WELL M-08
h/Ho
1.00
0.50
0.37
0.10
0.05
0.01
0
40
80
120
160
200
240
280
320
360
400
440
Time (seconds)
T0=6 sec.

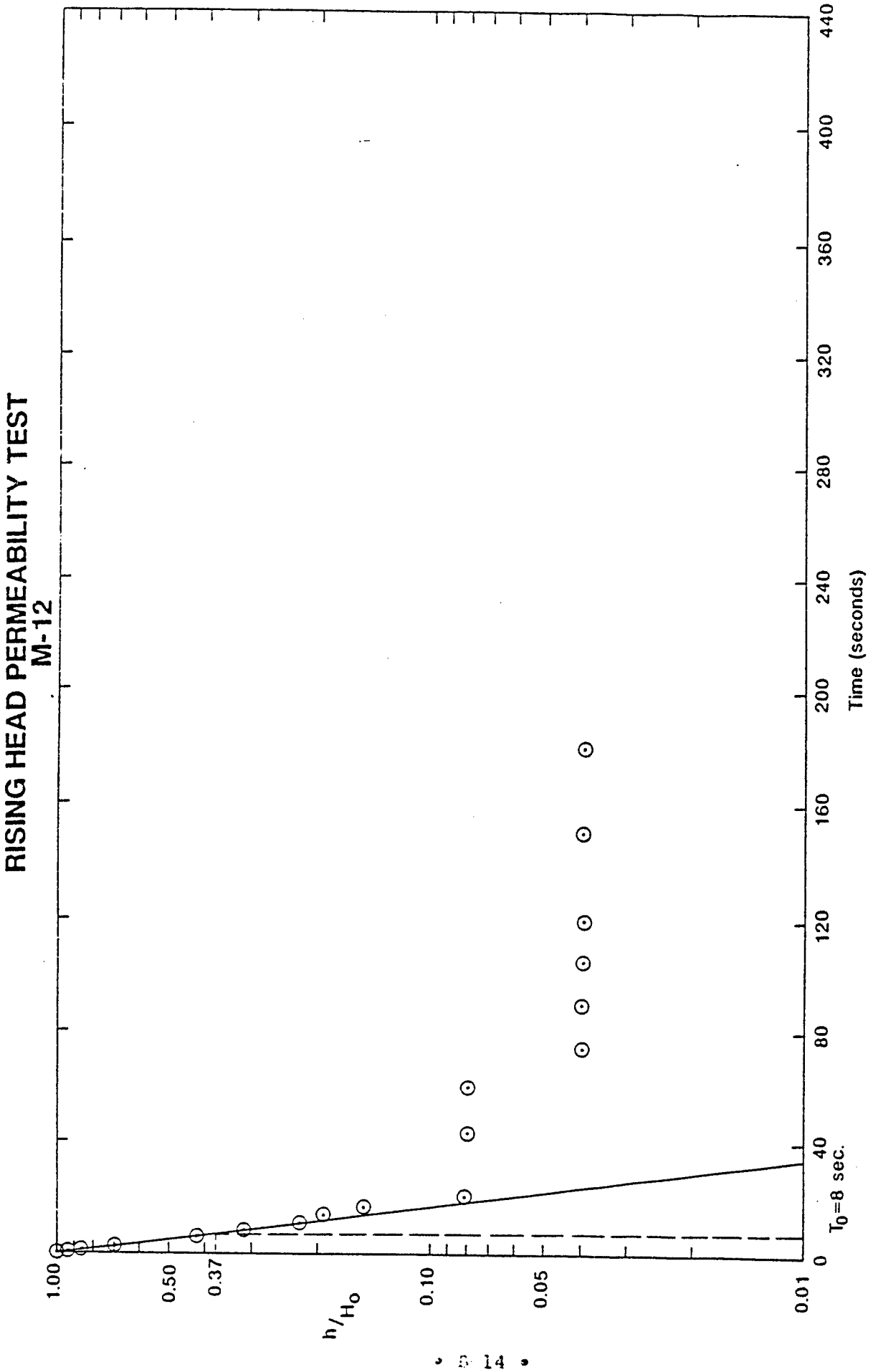
RISING HEAD PERMEABILITY TEST
WELL M-09



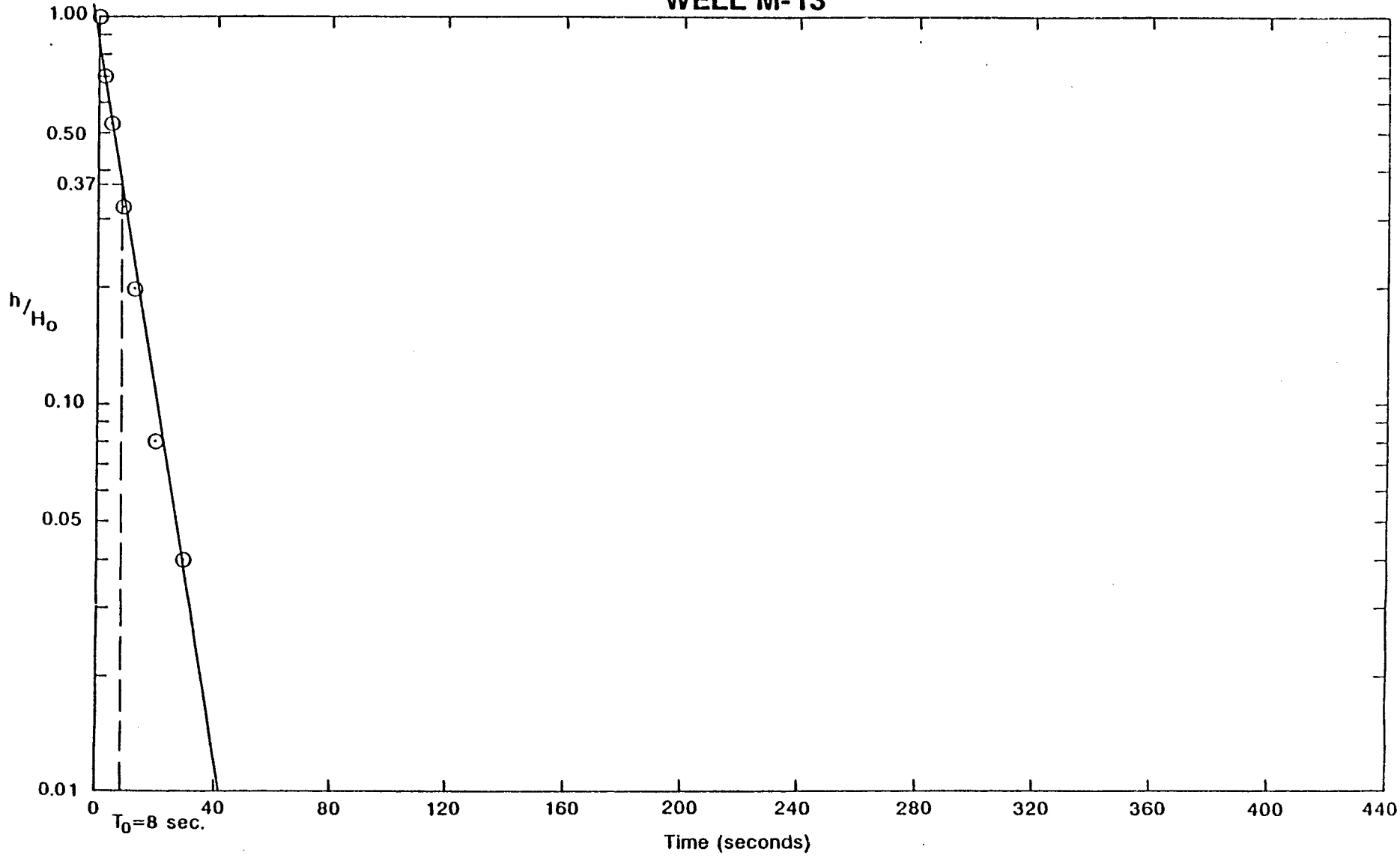

RISING HEAD PERMEABILITY TEST
WELL M-10
1.00
0.50
0.37
0.10
0.05
0.01
h/Ho
0
40
80
120
160
200
240
280
320
360
400
440
Time (seconds)
To=44 sec.

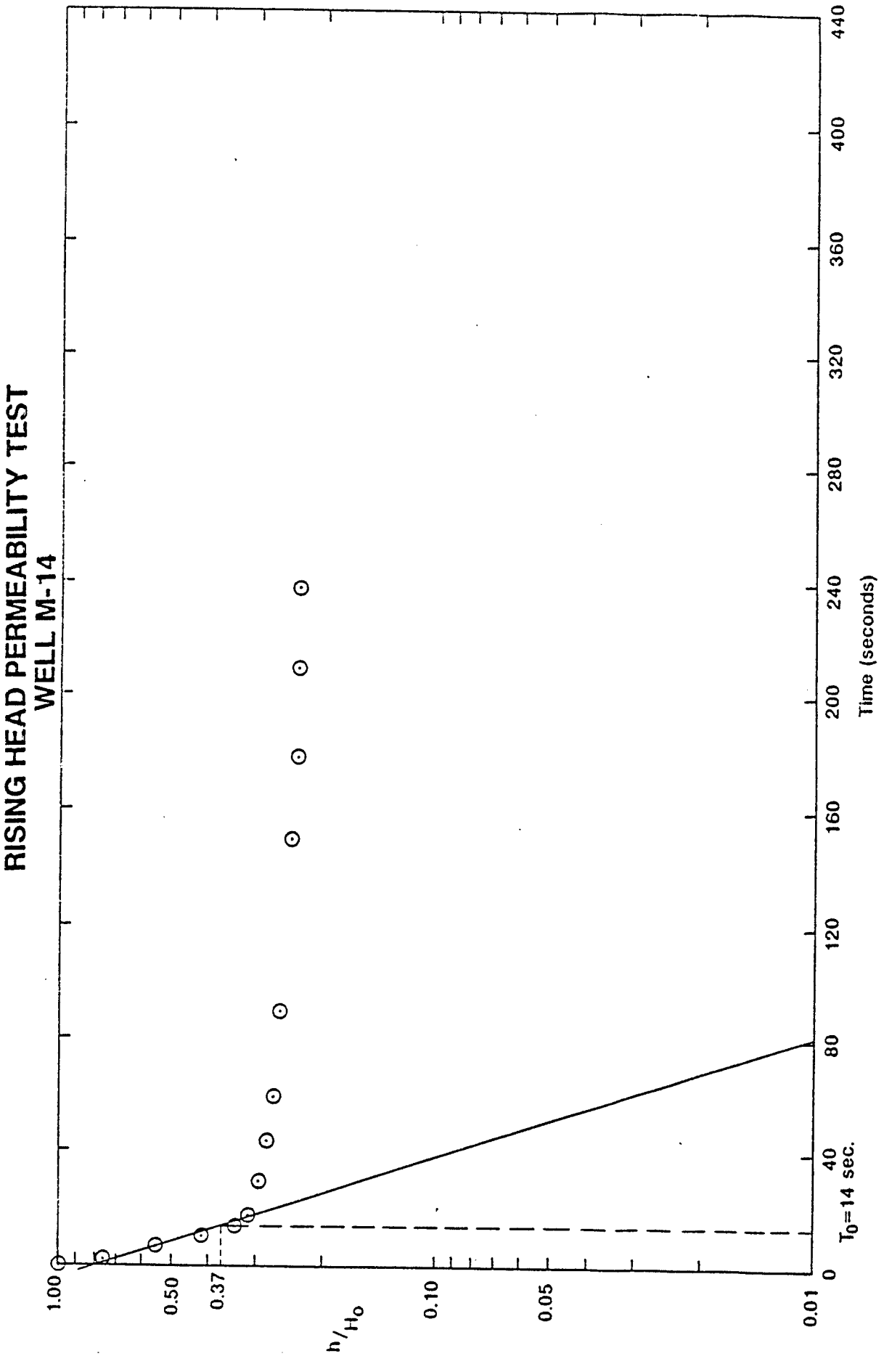
RISING HEAD PERMEABILITY TEST
M-11




RISING HEAD PERMEABILITY TEST
M-12
h/Ho
1.00
0.50
0.37
0.10
0.05
0.01
0
40
80
120
160
200
240
280
320
360
400
440
Time (seconds)
To=8 sec.

RISING HEAD PERMEABILITY TEST
WELL M-13




RISING HEAD PERMEABILITY TEST
WELL M-14
h/H0
1.00
0.50
0.37
0.10
0.05
0.01
0
40
80
120
160
200
240
280
320
360
400
440
Time (seconds)
T0=14 sec.

Example Packer Test Calculation

Hydraulic Conductivity = K

$$K = \frac{Q}{2\pi LH} \times \ln \frac{L}{R}$$

Test #1

Q - 0.36 gallons/minute
because 1.6 gallons (1049.6 - 1048.0)
were added in 4.5 minutes.

So

$$\frac{1.6 \text{ gal.}}{4.5 \text{ min.}} = 0.36 \text{ gallons/minute}$$

L = 10 feet (length of hole tested)
H = H (gravity) + H (pressure)
H (gravity) = feet from water table to water swivel = 31.13 feet
H (pressure) = average gauge pressure (feet)
= 2.31 x 12.3 psi = 28.41 feet
So H = 31.13 feet + 28.41 feet = 59.54 feet
R = 1.875 inches = 0.157 feet

$$\frac{0.36 \text{ GPM}}{2\pi(10 \text{ ft.})(59.54 \text{ ft.})} \times \ln \left(\frac{10 \text{ feet}}{0.157 \text{ feet}} \right) = 4.00 \times 10^{-4} \text{ Gpm/ft}^2$$

$$= 8.88 \times 10^{-7} \text{ cm/sec}$$

P_w max = 76 psi

PRESSURE TEST REPORT P_p

SHT 1 OF 1

PROJECT AMTL, WATERTOWN SITE WATERTOWN DATE 6/8/88 BORING No. C-1

LOCATION SW BLDG. 311 GROUND ELEV. _____ TOTAL DEPTH 78.0' TOP OF ROCK; DEPTH 61.0'

CONTRACTOR GZA DRILLING DRILLER P. WORDELL INSPECTOR R. PENDLETON CHEK'D BY _____

WATER LEVEL; DEPTH 26.0' ELEV. _____ WATER PIPE LENGTH 71.1' WATER PIPE I.D. 15/16"

FLOW METER No. ROCKWELL 3608650-1 PRESSURE GAUGE No. TRERICE TEST INTERVAL; DEPTH 68.0-78.0' ELEV. _____

GAUGE PRESS. ~~150~~ 10
PACKER INFL'T'N PRESS. 150

ELAPSED TIME Min.	FLOW READING Gal.	Δ FLOW
0:00	1,048	
0:30	1,048.8	.8
1:00	1,049.1	.3
1:30	1,049.2	.1
2:00	1,049.3	.1
2:30	1,049.3	0
3:00	1,049.3	0
3:30	1,049.3	0
4:00	1,049.3	0
4:30	1,049.6	.3
5:00		

REMARKS:
2:30 14 psi Gauge Press.
3:30 15 psi
4:00 15 psi

GAUGE PRESS. 21
PACKER INFL'T'N PRESS. 150

ELAPSED TIME Min.	FLOW READING Gal.	Δ FLOW
0:00	1,049.8	
0:30	1,049.8	0
1:00	1,050.0	0.2
1:30	1,050.4	0.4
2:00	1,050.4	0
2:30	1,050.4	0
3:00	1,050.4	0
3:30	1,050.4	0
4:00	1,050.4	0
4:30	1,050.4	0
5:00	1,050.4	0

REMARKS:
0:49 19 psi Gauge Press.
1:00 20 psi
1:24 22 psi
3:05 24 psi
3:30 22.5

GAUGE PRESS. ~~37~~ 35
PACKER INFL'T'N PRESS. 150

ELAPSED TIME Min.	FLOW READING Gal.	Δ FLOW
0:00	1,052.0	
0:30	1,052.2	0.2
1:00	1,052.4	0.2
1:30	1,052.7	0.3
2:00	1,052.7	0
2:30	1,052.8	0.1
3:00	1,052.8	0
3:30	1,052.8	0
4:00	1,052.8	0
4:30	1,052.8	0
5:00	1,052.8	0

REMARKS:
1:35 35.5 psi
2:35 36.5 psi

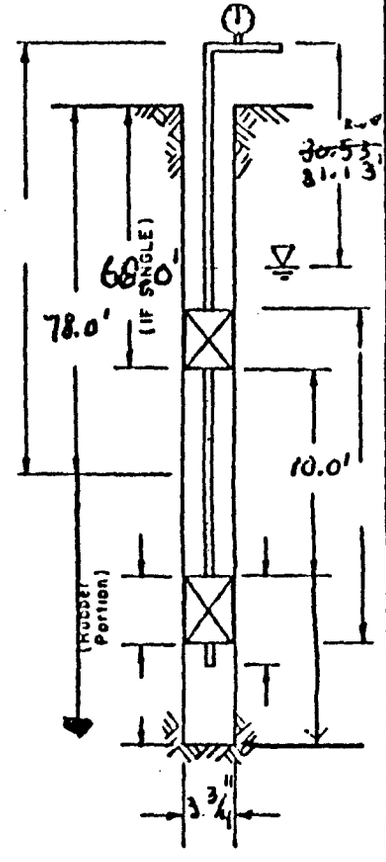
GAUGE PRESS. 51
PACKER INFL'T'N PRESS. 150

ELAPSED TIME Min.	FLOW READING Gal.	Δ FLOW
0:00	1,055.6	
0:30	1,0	2.1
1:00	1,057.5	
1:30		2.0
2:00	1,058.5	1.3
2:30	1,059.8	0.4
3:00	1,060.2	

REMARKS:
0:10 48 psi
1:05 52 psi
1:40 45 psi
2:07 49 psi
3:00 47.5 psi

NOTE: THIS TEST NOT USED DUE TO WATER LEAKING THROUGH WATER PIPE JOINTS.

TEST CONFIGURATION



SINGLE ☒
DOUBLE ☐
TAPE/RULE No. _____

C-2.

Weston Geophysical

F. Geophysical
Surveys

APPENDIX F

Geophysical Surveys

P.O Box 17203
Pittsburgh, PA 15235
Telephone (412) 243-3039

APPALACHIAN COAL SURVEYS

LOG HEADING
HOLE NO.
C - 1

COMPANY WESTON	LOCATION	UNIT 61 OFFICE Pgh
PROJECT Wtn Arsenal HOLE NO. C-1		OPERATOR CBC
CLIENT REPRESENTATIVE J. Rice	COUNTY Middlesex STATE MA	DATE 13-Jun-88
DRILLED DEPTH 78 FT ELEVATION FT.	CASING DEPTH 59 FT.	DRILLING FLUID WATER
HOLE DIAMETER 3.0 IN. WATER LEVEL 26 FT.	DIAMETER 4.0 IN. FACTOR	DRILLING CO. DRILLER
	WALL THICKNESS STRG IN.	

RUN #	LOG	INTERVAL (DEPTH) FT.	RANGE	TIME CONSTANT	SOURCE	SPACING
1	CALIPER	59 - 75	1 in/in			
2-3	NATURAL γ	0 - 75	100/50 CPS	2 SEC	NATURAL	
2	H.R DENSITY	59 - 75	1k CPS	1 SEC	Am 241	0.5 in.
3	γ γ DENSITY	6 - 59	5k CPS	1 SEC	Ra 226	12.0 in.
4	NEUTRON	6 - 75	1k CPS	1 SEC	Am-Be	12.0 in.
1,5	RESISTIVITY	59 - 75	20 Ω			
5	SPONTANEOUS POTENTIAL	59 - 73	200 MV			
5	TEMPERATURE	26 - 75	5 °F			
5	FLUID CONDUCTIVITY	26 - 75	50 Ω M			
	SONIC	-	μs/ft			2.0 FT.
	OTHER	-				

INTERPRETATION

- COAL < 10% ASH
- COAL > 10% ASH
- BONE / CARBONACEOUS SHALE > 50% ASH
- FIRECLAY / HOT SHALE
- LIMESTONE / OTHER CARBONATE
- SANDSTONE
- SILTY SANDSTONE
- SHALE / CLAYSTONE
- SANDY SHALE / SILTSTONE
- GROUNDWATER INFLOW
- GROUNDWATER OUTFLOW

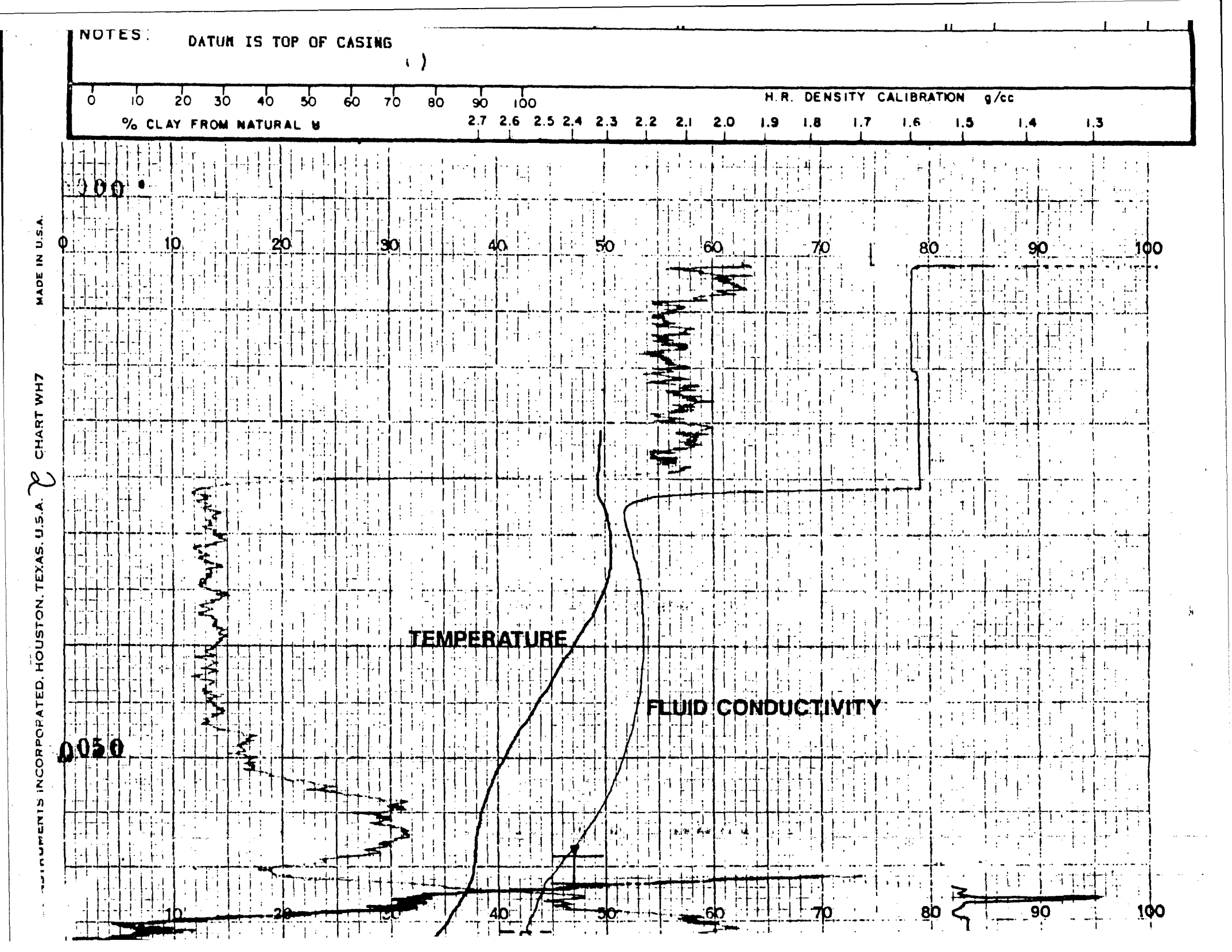
RUNS

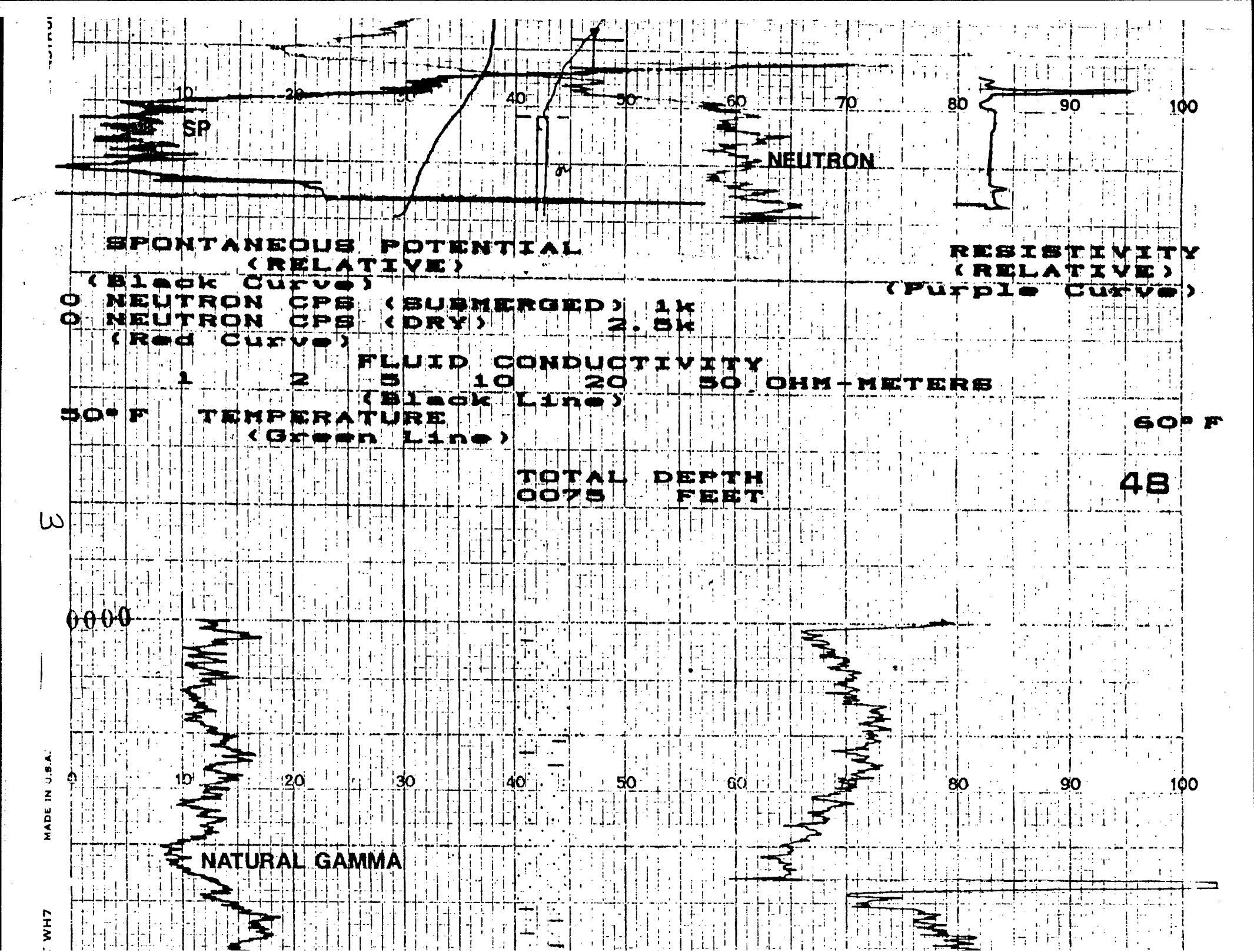
RUN #	INTERVAL (DEPTH) FT.	SCALE FT./IN.	LOGGING SPEED FT./MIN.
1	SUR - 75	10	50
2	SUR - 75	10	20
3	SUR - 59	10	20
4	SUR - 75	10	20
5	SUR - 75	10	20
	-		
	-		
	-		

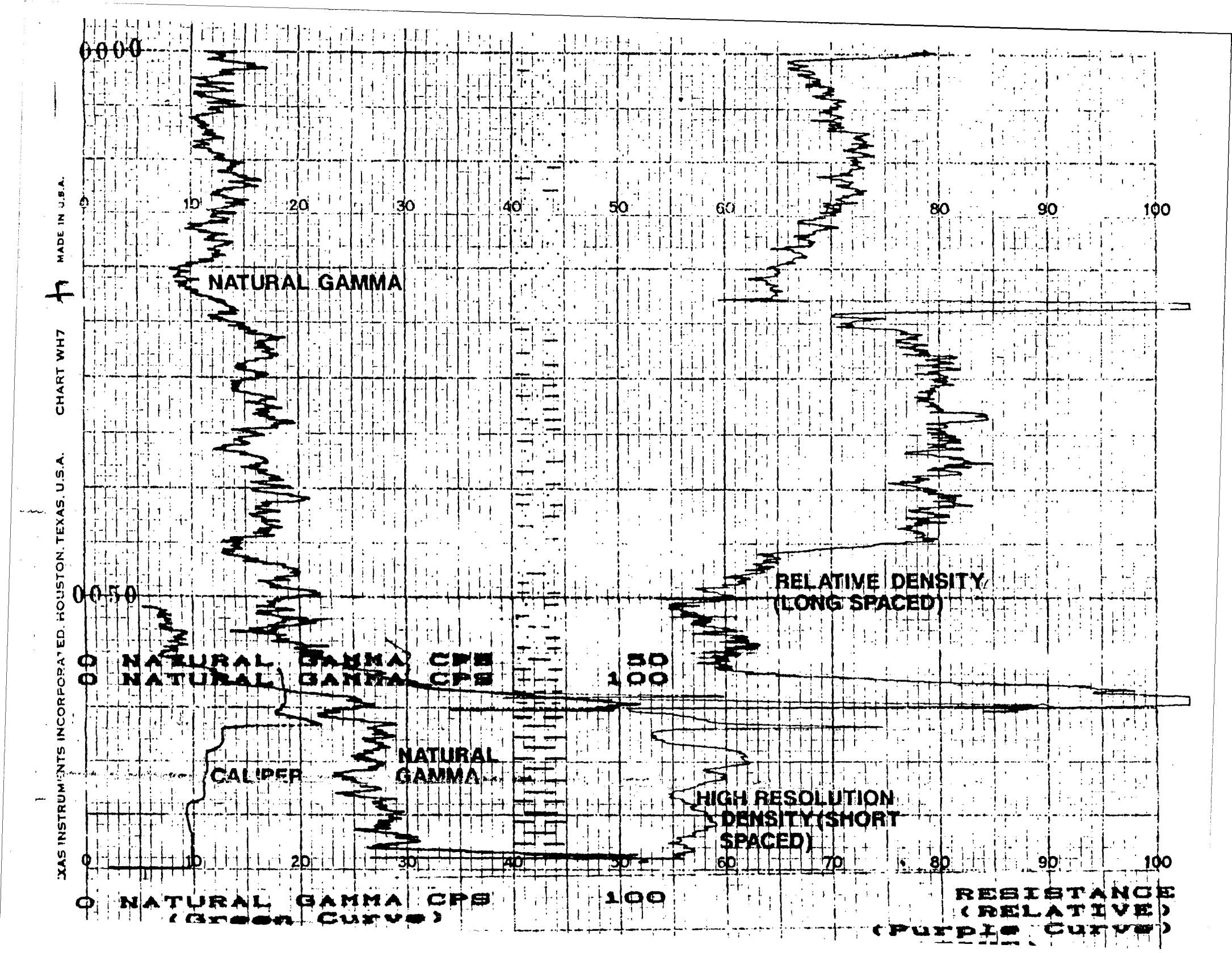
NOTES: DATUM IS TOP OF CASING

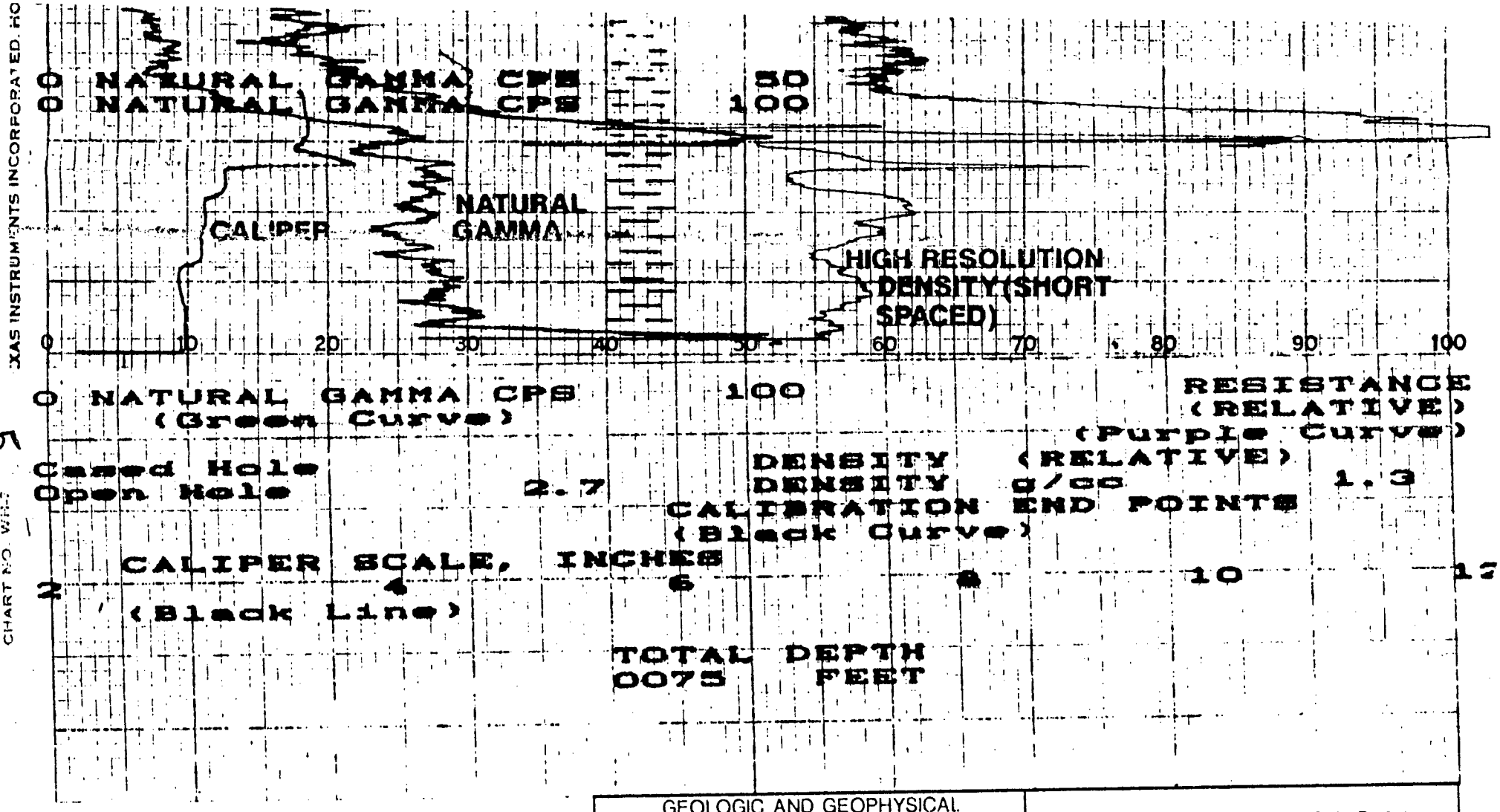
0 10 20 30 40 50 60 70 80 90 100

H.R. DENSITY CALIBRATION g/cc


NOTES:
DATUM IS TOP OF CASING
0 10 20 30 40 50 60 70 80 90 100
% CLAY FROM NATURAL γ
H.R. DENSITY CALIBRATION g/cc
2.7 2.6 2.5 2.4 2.3 2.2 2.1 2.0 1.9 1.8 1.7 1.6 1.5 1.4 1.3
000
0 10 20 30 40 50 60 70 80 90 100
TEMPERATURE
FLUID CONDUCTIVITY
0050
10 20 30 40 50 60 70 80 90 100
MADE IN U.S.A.
CHART WH7
INSTRUMENTS INCORPORATED. HOUSTON. TEXAS. U.S.A.


SP
NEUTRON
SPONTANEOUS POTENTIAL
(RELATIVE)
(Black Curve)
RESISTIVITY
(RELATIVE)
(Purple Curve)
0 NEUTRON CPS (SUBMERGED) 1k
0 NEUTRON CPS (DRY) 2.5k
(Red Curve)
FLUID CONDUCTIVITY
1 2 5 10 20 50 OHM-METERS
(Black Line)
50° F TEMPERATURE
(Green Line)
60° F
TOTAL DEPTH
0075 FEET
48
3
0000
NATURAL GAMMA
MADE IN U.S.A.
WH7


0000
0050
NATURAL GAMMA
RELATIVE DENSITY
(LONG SPACED)
0 NATURAL GAMMA CPS 50
0 NATURAL GAMMA CPS 100
CALIPER
NATURAL
GAMMA
HIGH RESOLUTION
DENSITY (SHORT
SPACED)
0 NATURAL GAMMA CPS 100
(Green Curve)
RESISTANCE
(RELATIVE)
(Purple Curve)
TEXAS INSTRUMENTS INCORPORATED, HOUSTON, TEXAS, U.S.A. CHART WH7 MADE IN U.S.A.



GEOLOGIC AND GEOPHYSICAL FIELD INVESTIGATIONS ARMY MATERIALS TESTING LABORATORY WATERTOWN, MASSACHUSETTS prepared for A. D. LITTLE, INC.	GEOPHYSICAL LOG OF C-01
Weston Geophysical	FIG. 3

7188

P.O Box 17203
Pittsburgh, PA 15235
Telephone (412) 243-3038

APPALACHIAN COAL SURVEYS

LOG HEADING
HOLE NO.
C-3

COMPANY WESTON	LOCATION	UNIT 61 OFFICE Pgh
PROJECT Wtn Arsenal HOLE NO. C-3		OPERATOR CBC
CLIENT REPRESENTATIVE J. Rice	COUNTY Middlesex STATE MA	DATE 01-Jul-88
DRILLED DEPTH 38 FT. ELEVATION FT.	CASING DEPTH 34 FT.	DRILLING FLUID HSA
HOLE DIAMETER 6.0 IN. WATER LEVEL 8 FT.	DIAMETER 2.0 IN. FACTOR	DRILLING CO. DRILLER
	WALL THICKNESS PVC IN.	

RUN #	LOG	INTERVAL (DEPTH) FT.	RANGE	TIME CONSTANT	SOURCE	SPACING
	CALIPER	-	in/in			
1, 2	NATURAL γ	0 - 28	100 CPS	2 SEC	NATURAL	
1	H.R. DENSITY	6 - 34	1k CPS	1 SEC	Am 241	0.5 in.
2	γγ DENSITY	6 - 34	5k CPS	1 SEC	Ra 226	12.0 in.
3	NEUTRON	6 - 34	1k CPS	1 SEC	Am-Be	12.0 in.
	RESISTIVITY	-	Ω			
	SPONTANEOUS POTENTIAL	-	MV			
4	TEMPERATURE	8 - 34	5 °F			
4	FLUID CONDUCTIVITY	8 - 34	50 Ω M			
	SONIC	-	us/ft			2.0 FT.
	OTHER	-				

INTERPRETATION

- COAL < 10% ASH
- COAL > 10% ASH
- BONE / CARBONACEOUS SHALE > 50% ASH
- FIRECLAY / HOT SHALE
- LIMESTONE / OTHER CARBONATE
- SANDSTONE
- SILTY SANDSTONE
- SHALE / CLAYSTONE
- SANDY SHALE / SILTSTONE
- GROUNDWATER INFLOW
- GROUNDWATER OUTFLOW

RUNS

RUN #	INTERVAL (DEPTH) FT.	SCALE FT./IN.	LOGGING SPEED FT./MIN.
1	SUR - 34	10	20
2	SUR - 34	10	20
3	SUR - 34	10	20
4	SUR - 34	10	20
	-		
	-		
	-		
	-		

NOTES: DATUM IS TOP OF CASING

NOTES: DATUM IS TOP OF CASING

0 10 20 30 40 50 60 70 80 90 100
% CLAY FROM NATURAL Ø

H.R. DENSITY CALIBRATION g/cc
2.7 2.6 2.5 2.4 2.3 2.2 2.1 2.0 1.9 1.8 1.7 1.6 1.5 1.4 1.3

0000

TEMPERATURE

FLUID CONDUCTIVITY

0 NEUTRON CPS (SUBMERGED) 1k
0 NEUTRON CPS (DRY) 2.5k
0 NEUTRON (DRY, GROUTED) 1k
(Red Curve)

FLUID CONDUCTIVITY
1 2 5 10 20 50 OHM-METERS
(Black Line)

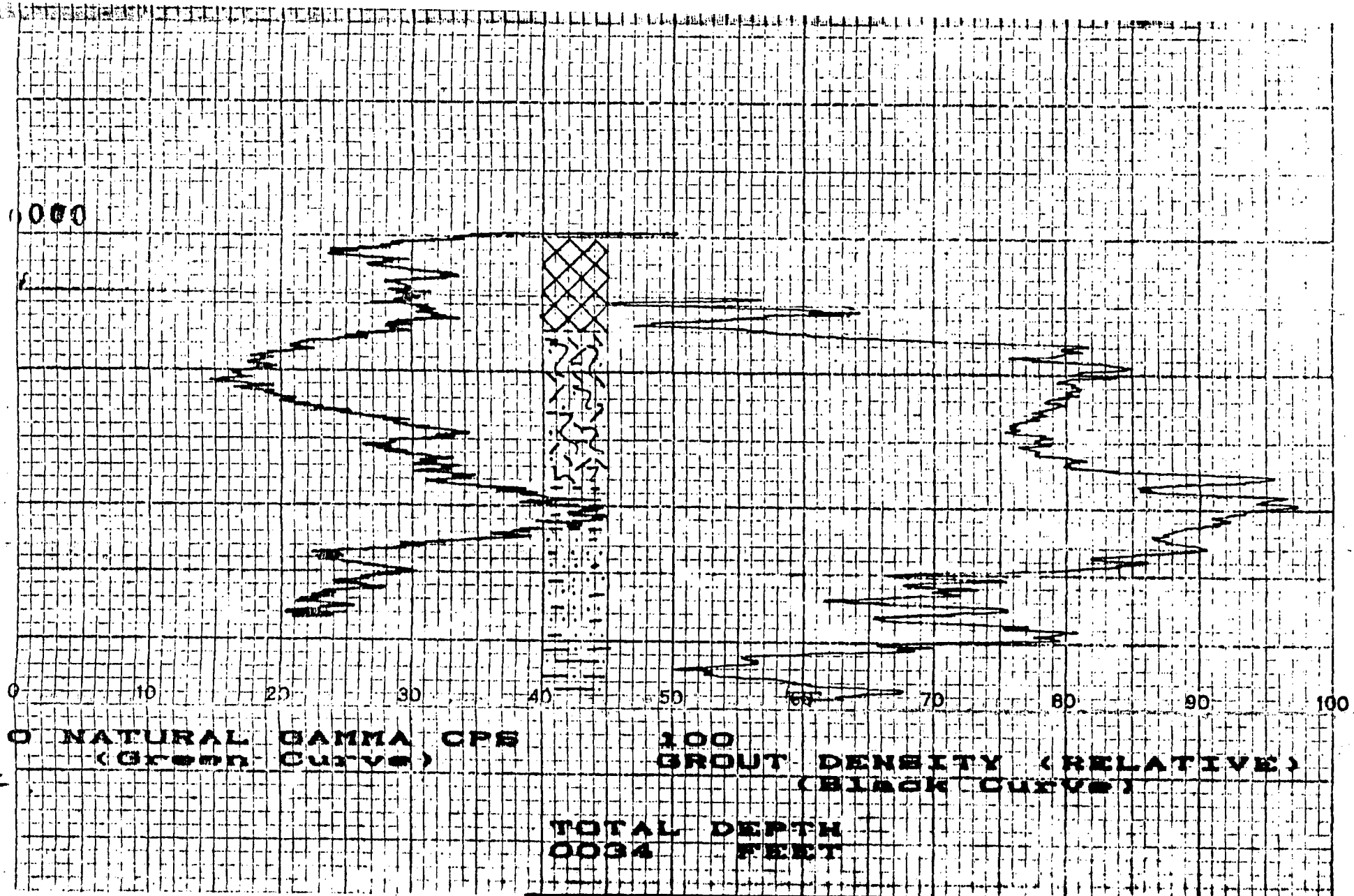
50° F TEMPERATURE 60°
(Green Line)

0 10 20 30 40 50 60 70 80 90 100

TOTAL DEPTH
0034 FEET

TEXAS INSTRUMENTS INCORPORATED, HOUSTON, TEXAS, U.S.A. CHART WH7 MADE IN

77
0 NATURAL GAMMA CPS 100
(OPEN CURVE)
FORMATION DENSITY (RELATIVE)
(BLACK CURVE)
0
10
20
30
40
50
60
70
80
90
100
TOTAL DEPTH
FEET
0000
0000
S. U.S.A.
CHART WH7
MADE IN U.S.A.



GEOLOGIC AND GEOPHYSICAL
FIELD INVESTIGATIONS
ARMY MATERIALS TESTING LABORATORY
WATERTOWN, MASSACHUSETTS
prepared for
A. D. LITTLE, INC.

GEOPHYSICAL LOG OF C-03

Weston Geophysical

FIG. 4

APPENDIX G

Physical Tests

[redacted] LA[redacted]ORATORY [redacted]TESTING DATA [redacted]SUMMARY [redacted] Rev[redacted]d by [redacted]

Date ______

Project No. L-10910 Project Engr. J. K. Assigned By R. L. Date Assigned July, 1988 Required ______

Boring No.	Sample No.	Depth ft.	Laboratory or Test No.	IDENTIFICATION TESTS							Perme-ability cm/s	STRENGTH TESTS					CONSOL.	Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	G_s	γ_d pcf		Torvane or Type Test	σ_c or $\bar{\sigma}_c$ or σ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	C_c / e_o	
C1	T1	24-27	20															Brown SILT, trace fine Sand
		24.2		27.3														
		24.2-24.7		27.0	23	23	96		2.72									
		24.7		27.0														
		24.8-25.1		31.6						91.8	2.2×10^{-6}	K	$\bar{\sigma}_c$ = 1440					
		25.1		31.1														
		25.1-25.7		SAVE														
C1		47.4-49.4	15		22	20	76		2.71									Brown Clayey SILT, some fine Sand
C3	T1	11-13	21		Average Total Unit Weight (11.0 - 12.7') = 97.0 pcf													Dark grey to black fine to coarse SAND and (-) organic Silt, trace fine Gravel
		11.2		88.8														
		11.4		96.5														
		11.5-11.8		79.0						50.9	1.0×10^{-7}	K	$\bar{\sigma}_c$ = 1440					
		11.8		67.2														
		11.8-12.1		67.4	88	45	39		2.36									
		12.1		85.9														
		12.5		87.3														
C3		29-31	28				6		2.74									Brown fine to coarse SAND, some (+) fine Gravel, trace Silt

SUMMARY OF LAB TESTS
TABLE NUMBER ______

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS

APTL

[redacted]rto[redacted]A [redacted] [redacted] [redacted] [redacted] LABORATORY TESTING DATA SUMMARY [redacted] [redacted] [redacted]vie[redacted] by [redacted]

Date _____

Project No. L10910 Project Engr. J. Kerwin Assigned By R. Lambe Date Assigned May 88 Required _____

Boring No.	Sample No.	Depth ft.	Laboratory or Test No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	POROSITY n(%)	G_s	γ_d pcf	Permeability cm/sec	STRENGTH TESTS: Torvane or Type Test	σ_c or $\bar{\sigma}_c$ or σ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL. C_c / e_o	Laboratory Log and Soil Description
M2	T1	16-18	1	Average Total Unit Weight (16.0 - 18.2') = 126.0 pcf														Brown SILT, little (-) fine Sand, trace Clay & Silt Lenses, trace (+) fine Sand lenses
		16.4		24.3														
		16.8		24.2														
		16.8-17.1		Save														
		17.1-17.3							2.72									
		17.3		25.6														
		17.4-17.7		28.3				43		96.5	1.5×10^{-6}	K	$\bar{\sigma}_c$ = 1440					
		17.7		26.4														
		17.7-18.1		25.6	22	22	89											
		18.1		26.6														
M0	T1	11-13	2	Average Total Unit Weight (11.0 - 12.8') = 128.3 pcf														Brown SILT & CLAY, little fine to medium Sand @ 11.7' change to Brown CLAY & SILT, trace (-) fine Sand
		11.2		21.8														
		11.5		19.8														
		11.7-12.0		24.2						105.2	2.5×10^{-7}	K	$\bar{\sigma}_c$ = 1440					
		12.1		33.5														
		12.1-12.5		29.0	37	22	97	39	2.74									
		12.5		31.7														
		12.5-12.8		Save														

SUMMARY OF LAB TESTS
TABLE NUMBER _____

LABORATORY TESTING DATA SUMMARY

Reviewed by [redacted]

Date

Project No. L-10910 Project Engr. J. K. Assigned By R. L. Date Assigned July, 1988 Required

Boring No.	Sample No.	Depth ft.	Laboratory or Test No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	G_s	γ_d pcf	Permeability	STRENGTH TESTS: Torvane or Type Test	σ_c or $\bar{\sigma}_c$ or σ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL. C_c / e_o	Laboratory Log and Soil Description
M3		4-6	26				9		2.72									Brown medium to coarse GRAVEL and medium to coarse SAND, trace Silt
M4		14-16	16				6		2.76									Brown fine to coarse GRAVEL and medium to coarse SAND, trace Silt
M5		14-16	25		20	20	42		2.71									Brown fine SAND and SILT
MØ-06			9		22	22	7		2.64									Grey fine SAND, trace fine fine Gravel, trace Silt
MØ-7		0-2	23		20	20	26		2.59									Dark brown fine to medium SAND, some fine Gravel, some Silt
MØ-8		4-6	27		21	21	11		2.71									Brown fine to coarse SAND and (-) fine to coarse Gravel little(-) Silt
M10		17-19	13		39	23	40		2.74									Olive-grey CLAY & SILT

SUMMARY OF LAB TESTS
TABLE NUMBER

LABORATORY TESTING DATA SUMMARY

Project No. L-10910 Project Engr. J. K. Assigned By R. L. Date Assigned July, 1988 Required

Date

Boring No.	Sample No.	Depth ft.	Laboratory or Test No.	IDENTIFICATION TESTS							Permeability	STRENGTH TESTS					CONSOL.	Laboratory Log and Soil Description
				Water Content %	LL %	PL %	Sieve -200 %	Hyd -2μ %	G_s	γ_d pcf		Torvane or Type Test	σ_c or $\bar{\sigma}_c$ or σ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	C_c / e_o	
M11		2-4	22		44	38	11		2.63									Dark brown fine to coarse SAND and fine to coarse GRAVEL, little(-) Silt
M13		19-21	72		22	22	76		2.71									Brown SILT, some Sand, trace fine Gravel

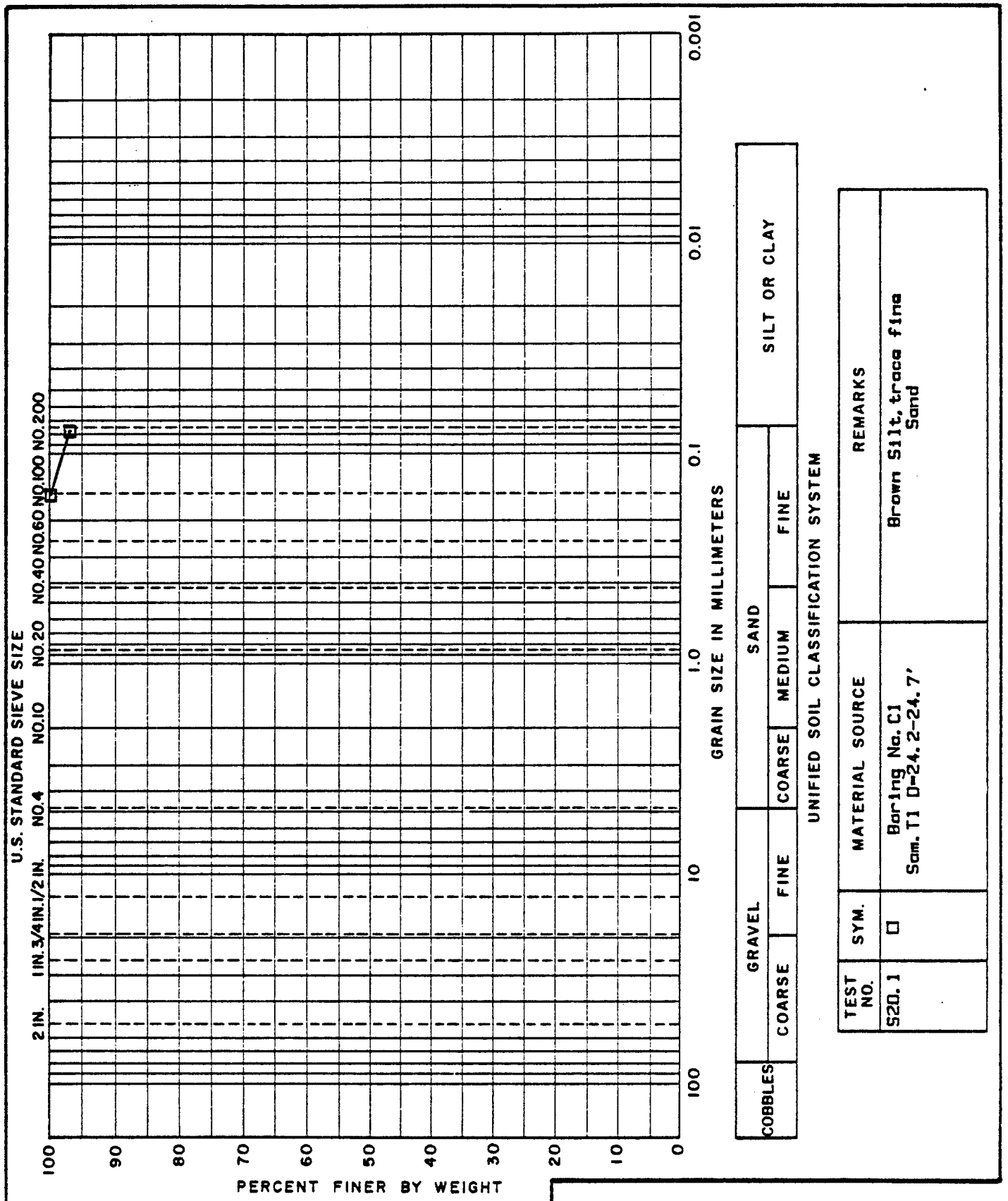
SUMMARY OF LAB TESTS
TABLE NUMBER

Waterlown, [redacted] LABORATORY TEST DATA SHEET [redacted] by [redacted]
Date

Project No. L-10910 Project Engr. J. Kerwin Assigned By R. Lambe Date Assigned May 88 Required

Boring No.	Sample No.	Depth ft.	Laboratory or Test No.	IDENTIFICATION TESTS: Water Content %	LL %	PL %	Sieve -200 %	POROSITY n(%)	G_s	γ_d pcf	Permeability cm/sec	STRENGTH TESTS: Torvane or Type Test	σ_c or $\bar{\sigma}_c$ or σ psf	Failure Criteria	$\sigma_1 - \sigma_3$ or τ psf	Strain %	CONSOL. C_c / θ_o	Laboratory Log and Soil Description
M14	T2	16-18	3		Average total unit weight (16.0 - 18.1') = 123.1 pcf													
		16.3		20.2														Brown fine to coarse SAND, some Gravel, some Silty Clay
		16.6		26.9														@ 16.3' change to-
		16.6-17.0		29.6						91.0	6.0×10^{-7}		$\bar{\sigma}c = 1440$					Olive gray Silty CLAY of high plasticity, little thin Silt Lenses
		17.0		30.2														@ 17.6' change to Gray SILT, trace fine Sand
		17.0-17.2		30.7	34	20		47	2.76									
		17.2		32.1														
		17.2-17.4					99											
		17.4-17.8		save														
		17.8		27.3														
MW12	JAR	12-14	4		Non-Plastic		2		2.71									Brown fine to medium SAND, some (+) Gravel, trace (-) Silt.

SUMMARY OF LAB TESTS
TABLE NUMBER



TEST NO.	SYM.	MATERIAL SOURCE	REMARKS
S20.1	□	Boring No. C1 Sam. T1 D=24.2-24.7'	Brown Silt, trace fine Sand

AMTL

WATERTOWN, MASS

GRADATION TESTS

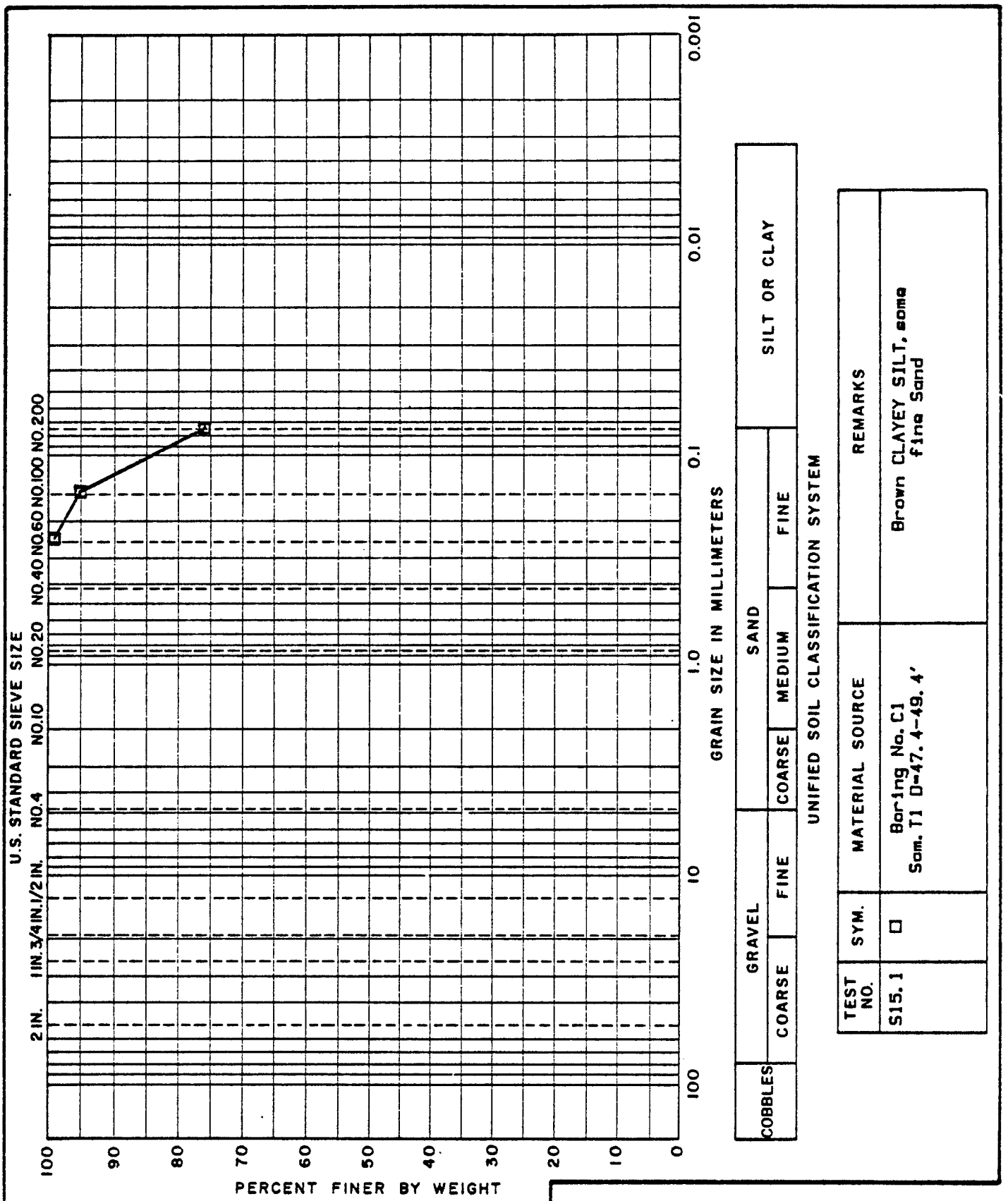
BORING NO. C1
SAMPLE T1
DEPTH 24.2-24.7'
TECH. MT
REVIEWER

TEST SERIES NO. 20
DATE June 88
L10810

FILE

APPENDIX E-9

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



AMTL

WATERTOWN, MASS

GRADATION TESTS

BORING NO. C1
SAMPLE T1
DEPTH 47.4-48.4'
TECH. MT
REVIEWER

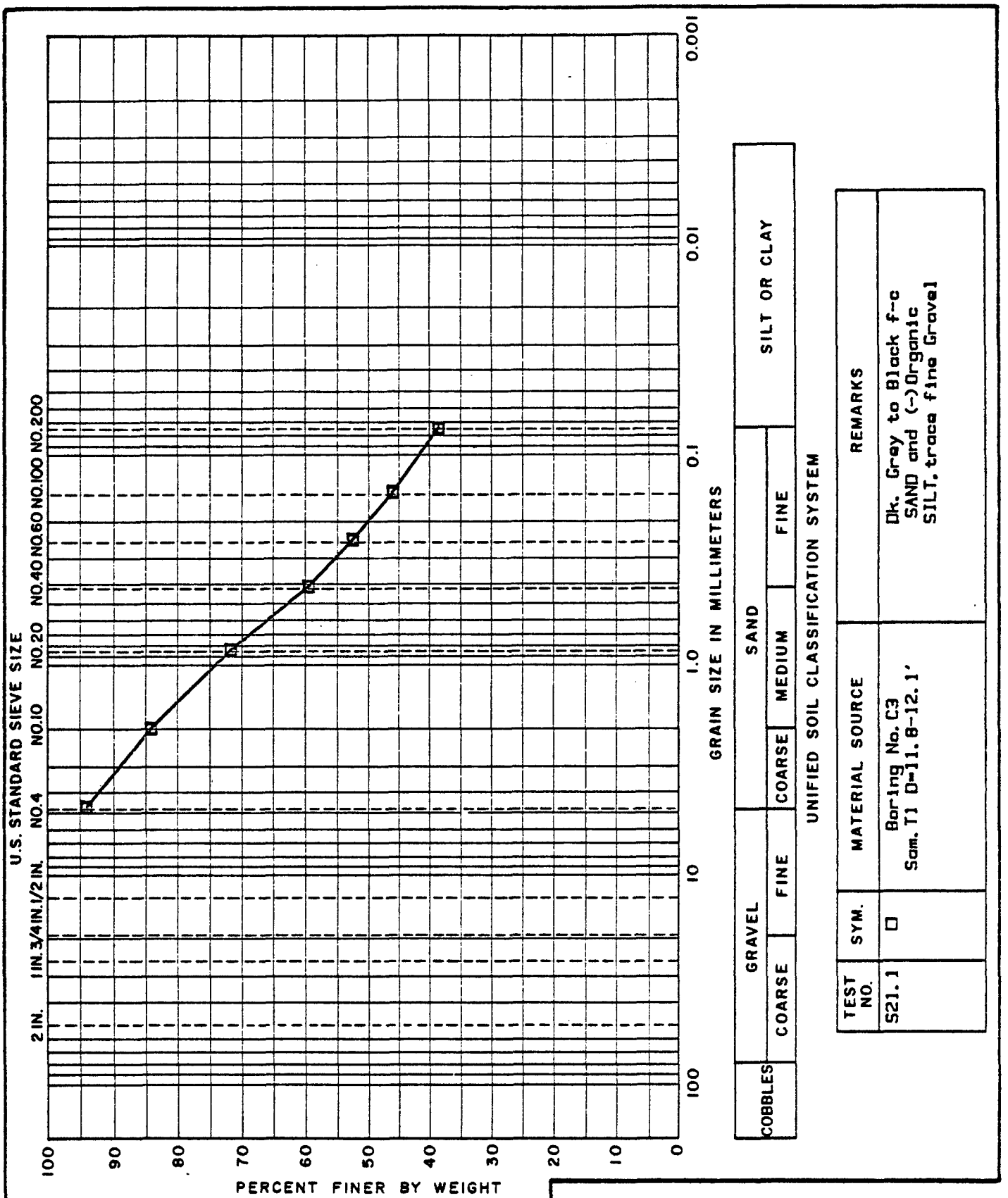
TEST SERIES NO. 15
DATE Aug. 88
L10910

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



AMTL

WATERTOWN, MASS

GRADATION TESTS

BORING NO. C3
SAMPLE T1
DEPTH 11.8-12.1'
TECH. MT
REVIEWER

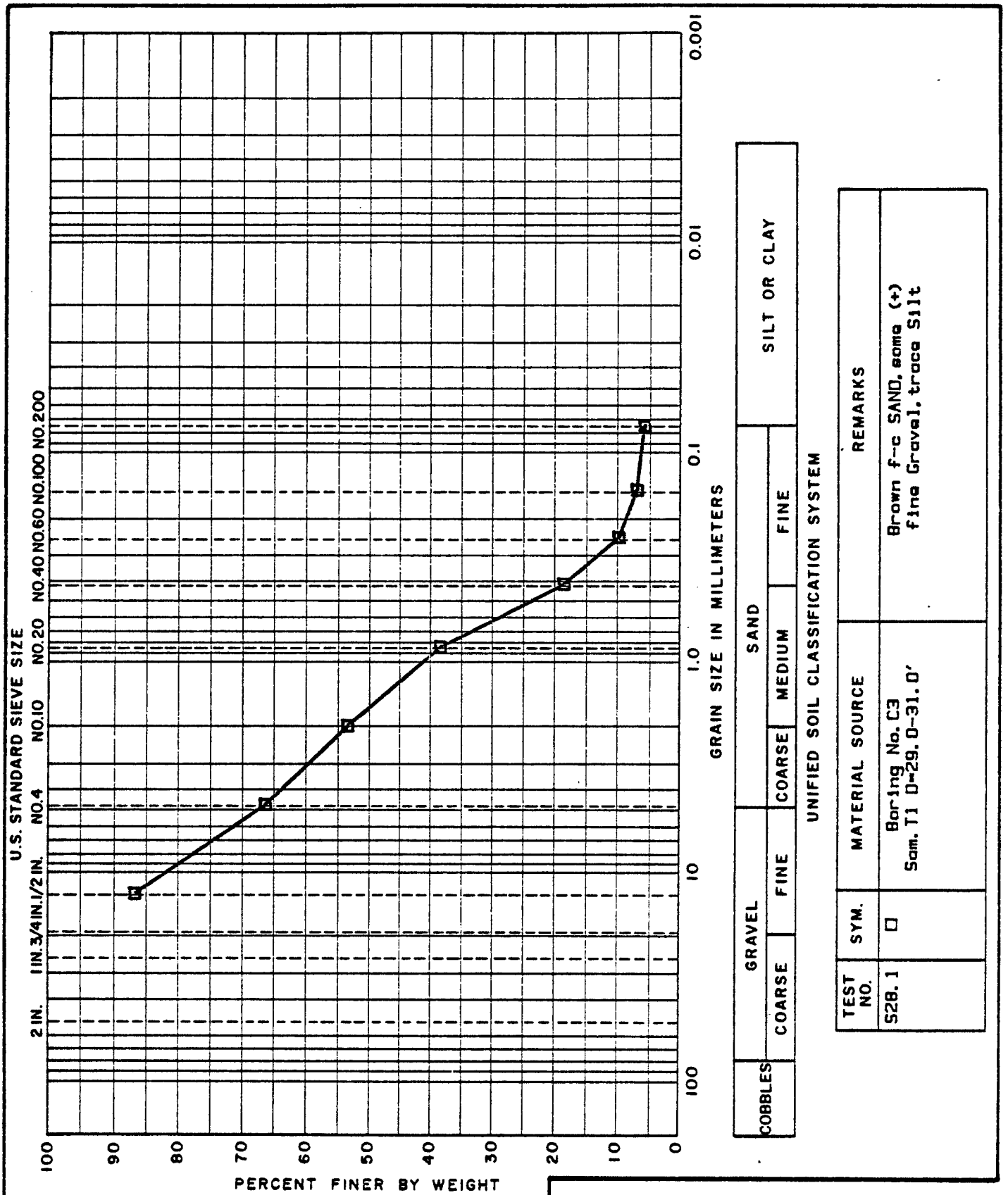
TEST SERIES NO. 21
DATE Aug. 88
L10810

FILE

APPENDIX E-9

S-3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



AMTL

WATERTOWN, MASS

GRADATION TESTS

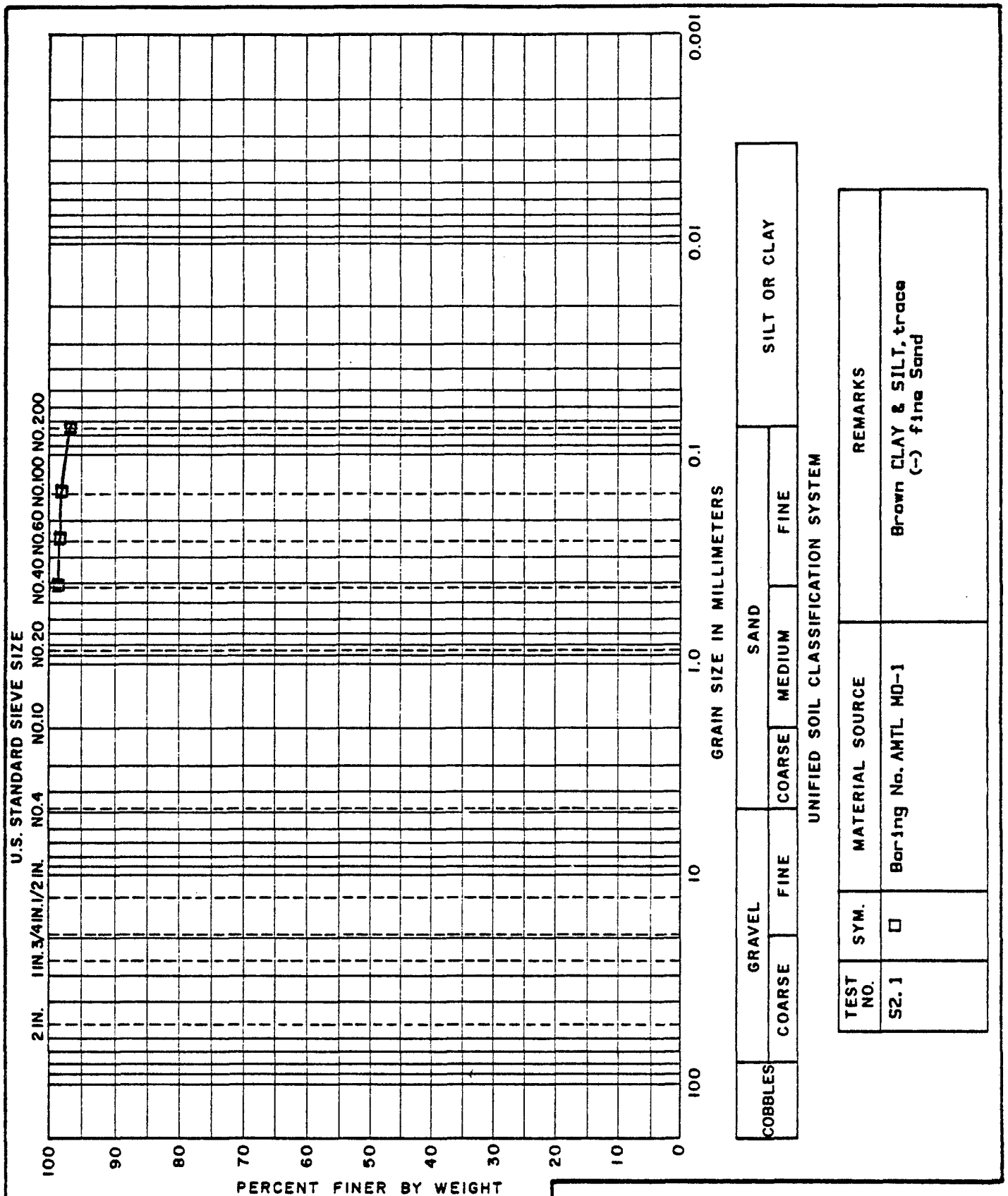
BORING NO. C3
SAMPLE T1
DEPTH 29.0-31.0'
TECH. MT
REVIEWER

TEST SERIES NO. 28
DATE Aug. 88
L10910

FILE

APPENDIX E-9

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



AMTL

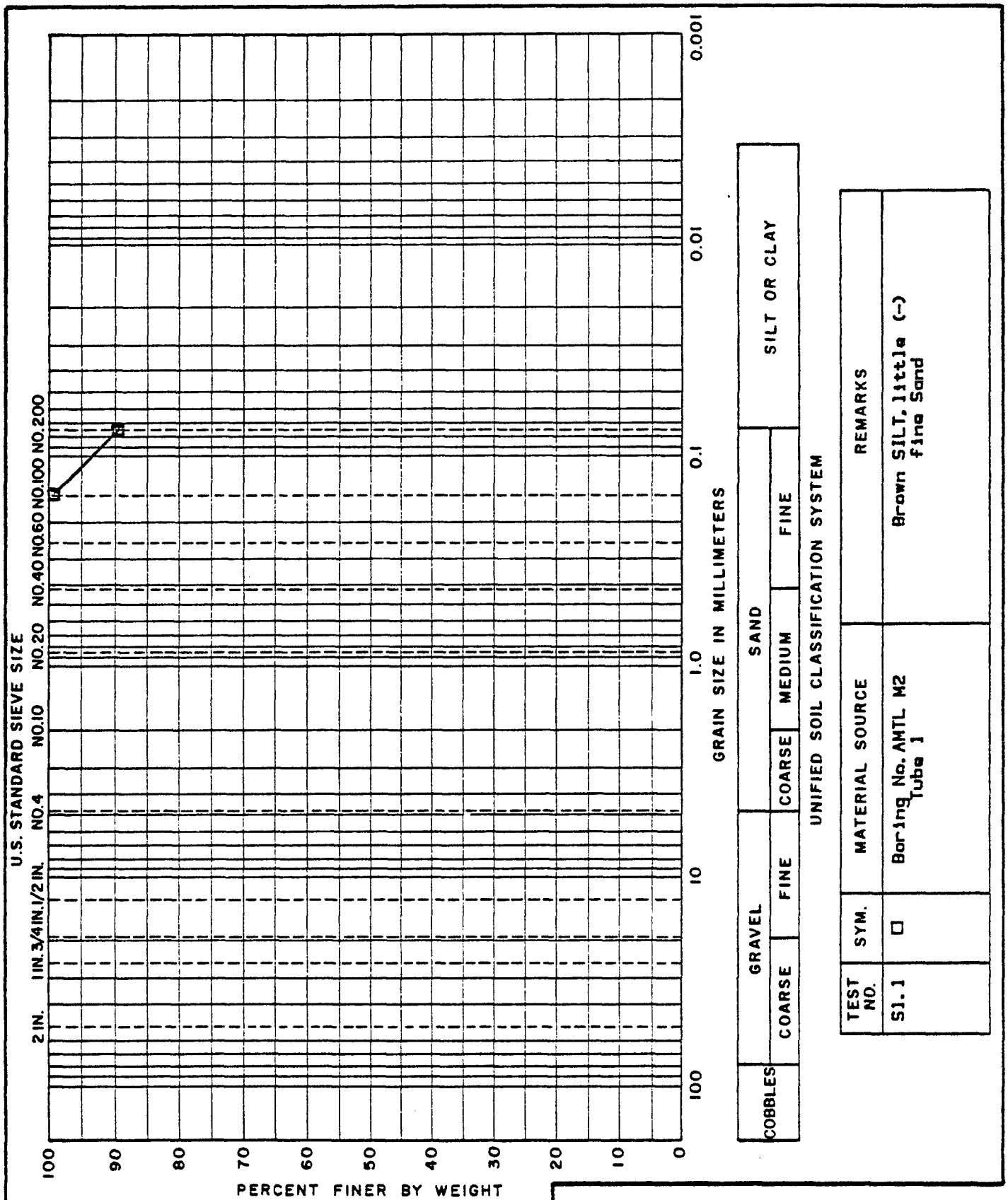
WATERTOWN, MASS

GRADATION TESTS

BORING NO. MD
SAMPLE
DEPTH 11-13'
TECH. MT
REVIEWER

TEST SERIES NO. 2
DATE June 88
L10810

FILE



TEST NO.	SYM.	MATERIAL SOURCE	REMARKS
S1.1	□	Boring No. AMTL M2 Tube 1	Brown SILT, little (-) fine Sand

AMTL

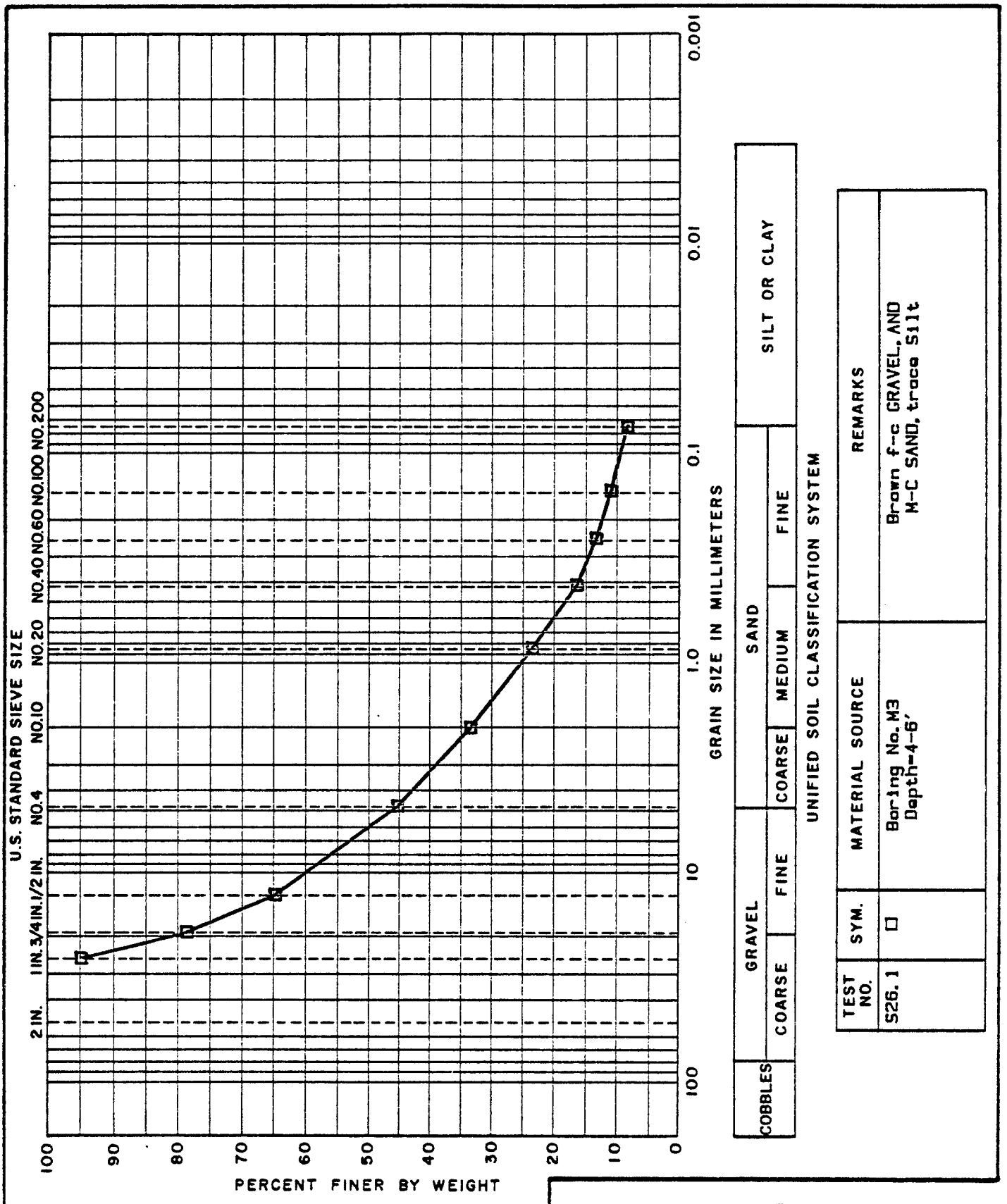
WATERTOWN, MASS

GRADATION TESTS

BORING NO. M2
SAMPLE
DEPTH 16-16'
TECH. MT
REVIEWER

TEST SERIES NO. 1
DATE June 88
L10810

FILE



TEST NO.	SYM.	MATERIAL SOURCE	REMARKS
S26.1	□	Boring No. M3 Depth=4-6'	Brown f-c GRAVEL, AND M-C SAND, trace Silt

AMTL

WATERTOWN, MASS

GRADATION TESTS

BORING NO. M3
SAMPLE
DEPTH 4-6'
TECH. MT
REVIEWER

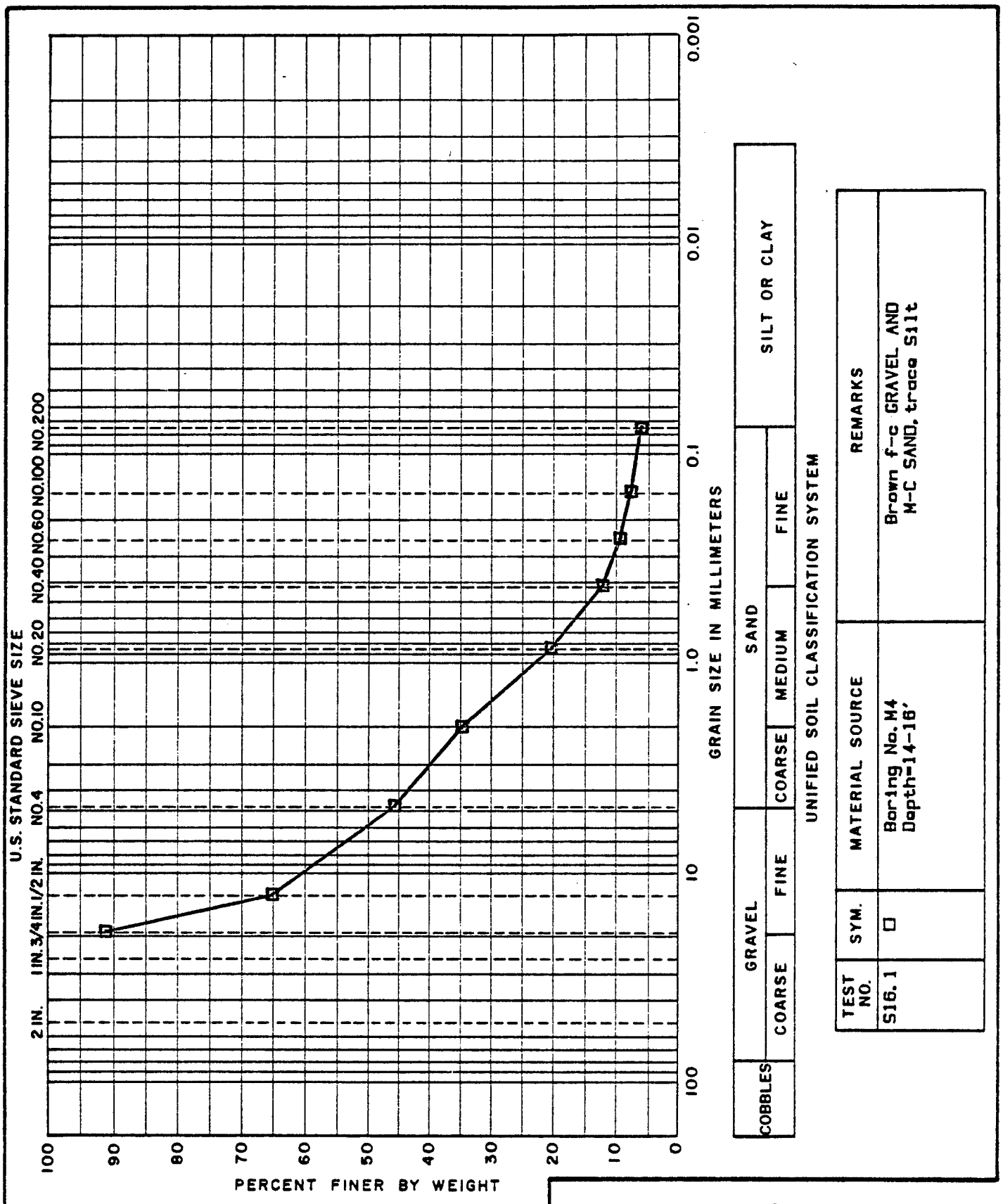
TEST SERIES NO. 26
DATE Aug. 88
L10910

FILE

APPENDIX E-9

S3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



AMTL

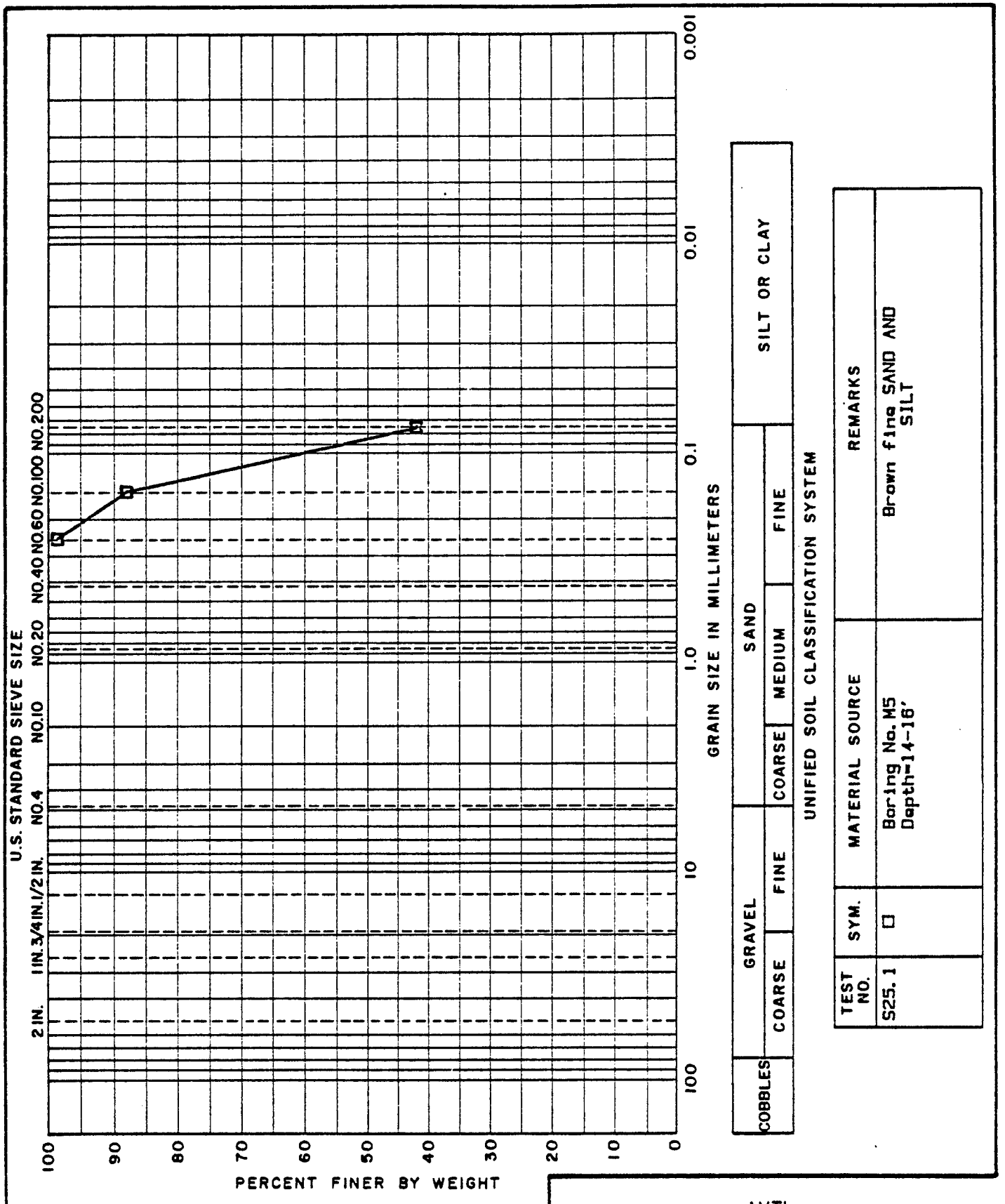
WATERTOWN, MASS

GRADATION TESTS

BORING NO. M4
SAMPLE
DEPTH 14-16'
TECH. MT
REVIEWER

TEST SERIES NO. 16
DATE Aug. 88
L10910

FILE



AMTL

WATERTOWN, MASS

GRADATION TESTS

BORING NO. M5
SAMPLE
DEPTH 14-16'
TECH. MT
REVIEWER

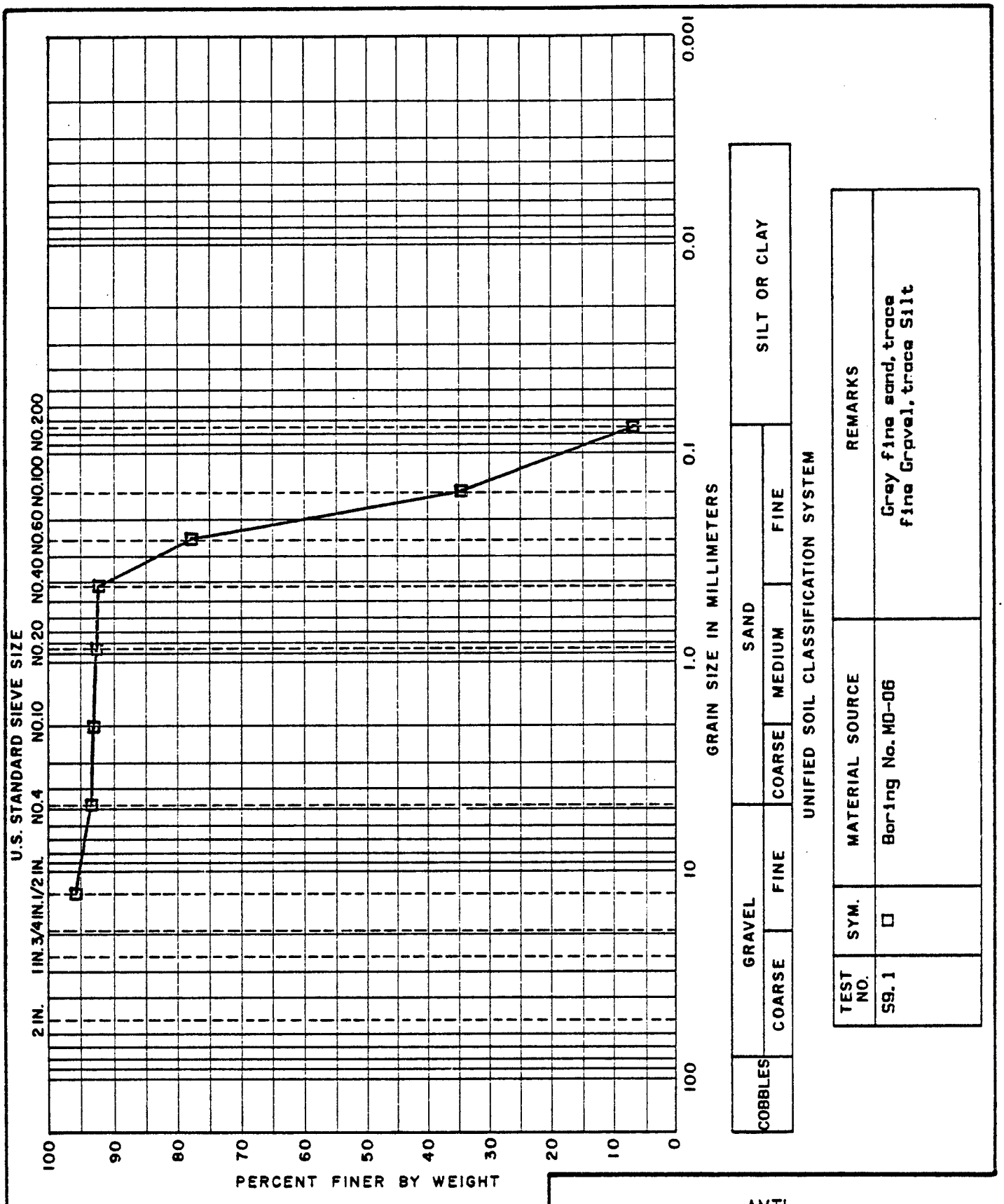
TEST SERIES NO. 25
DATE Aug. 88
L10810

FILE

APPENDIX E-9

S-3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



AMTL

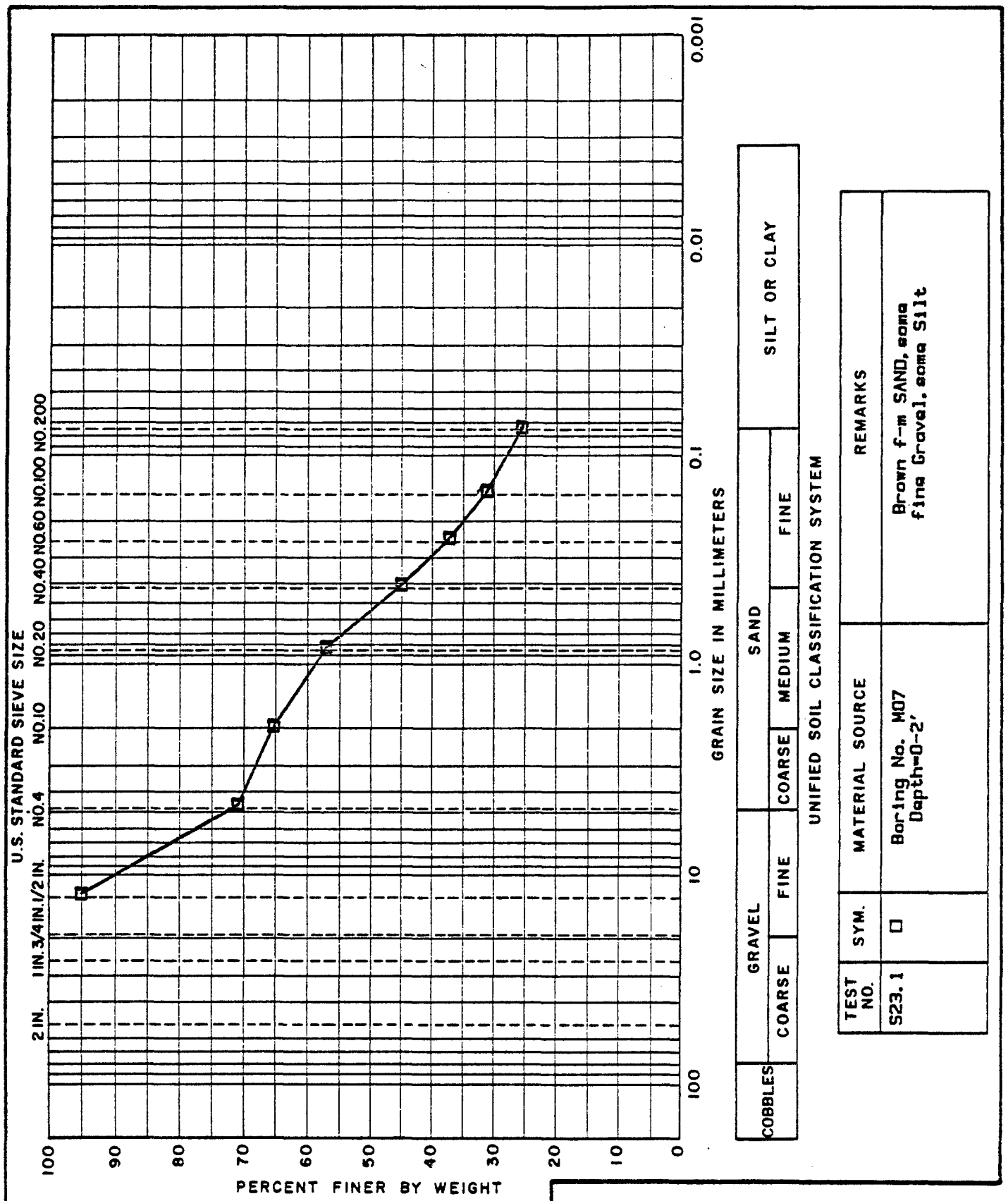
WATERTOWN, MASS

GRADATION TESTS

BORING NO. MD-06
SAMPLE
DEPTH
TECH. KT
REVIEWER

TEST SERIES NO. 9
DATE Aug. 88
L10810

FILE



AMTL

WATERTOWN, MASS

GRADATION TESTS

BORING NO. M07
SAMPLE
DEPTH 0-2'
TECH. BF
REVIEWER TW

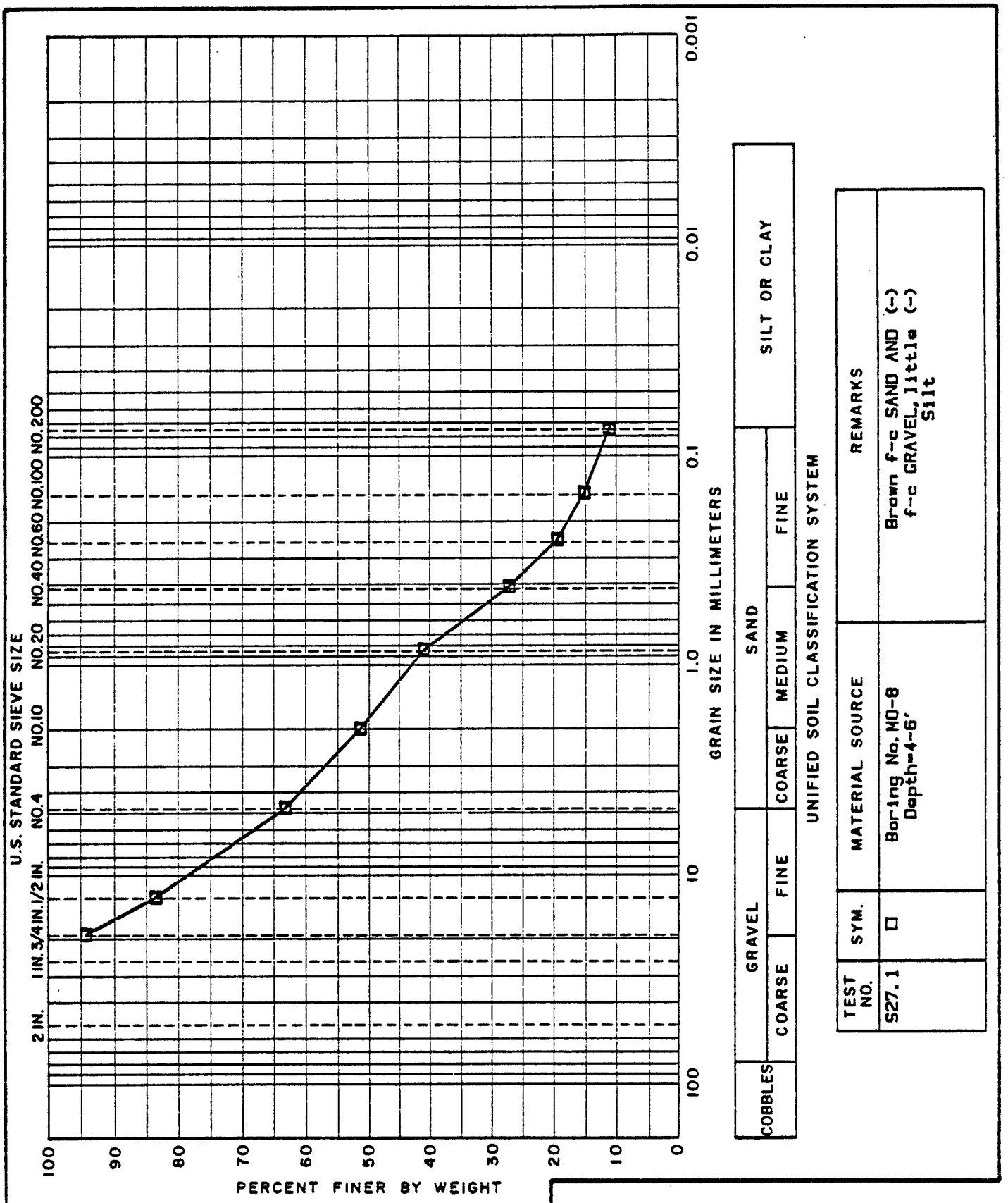
TEST SERIES NO. 23
DATE Aug. 88
L1G810

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



AMTL

WATERTOWN, MASS

GRADATION TESTS

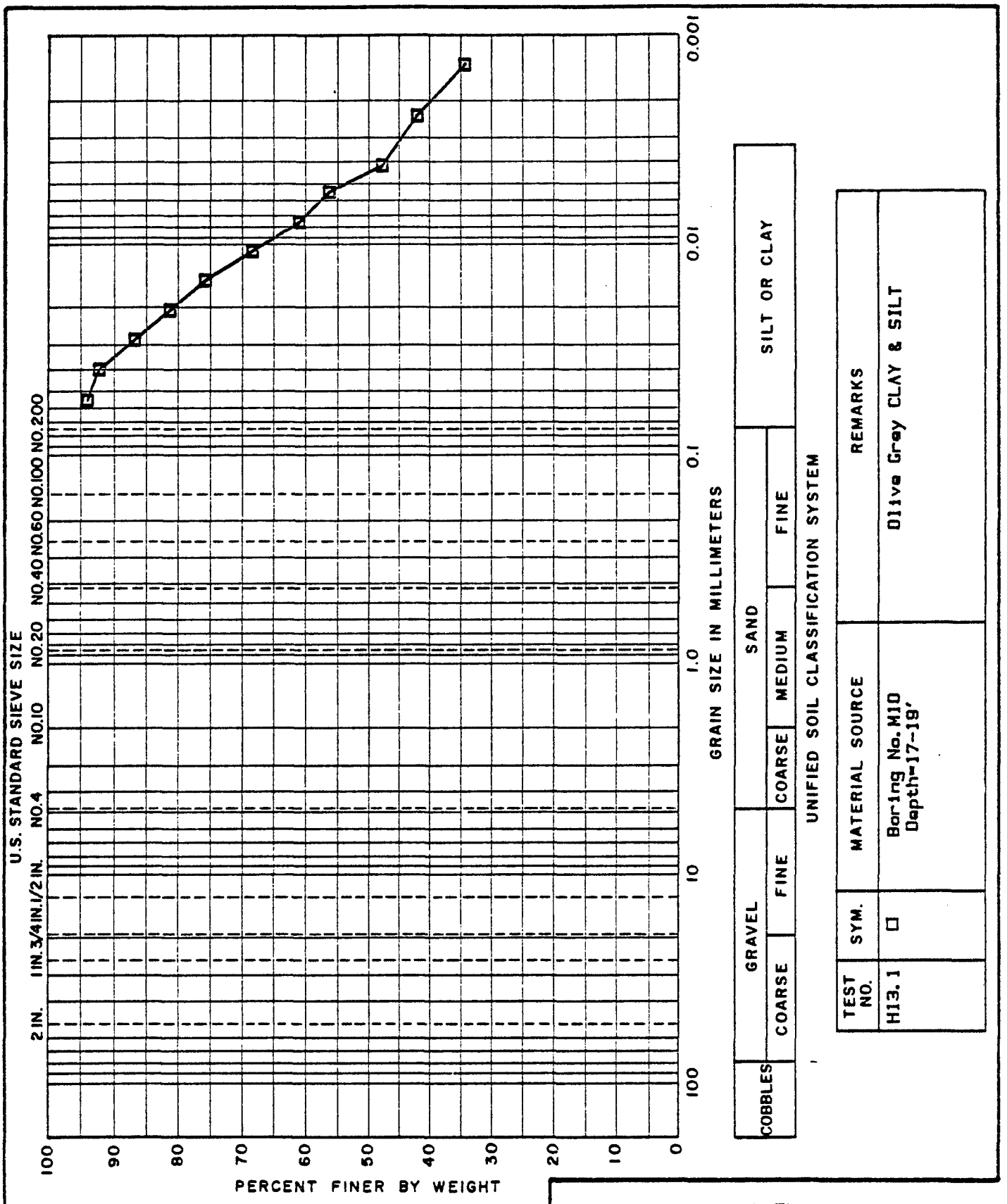
BORING NO. MD-8
SAMPLE
DEPTH 4-6'
TECH. MT
REVIEWER

TEST SERIES NO. 27
DATE Aug. 88
L10910

FILE

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS

APPENDIX E-9



AMTL

WATERTOWN, MASS

GRADATION TESTS

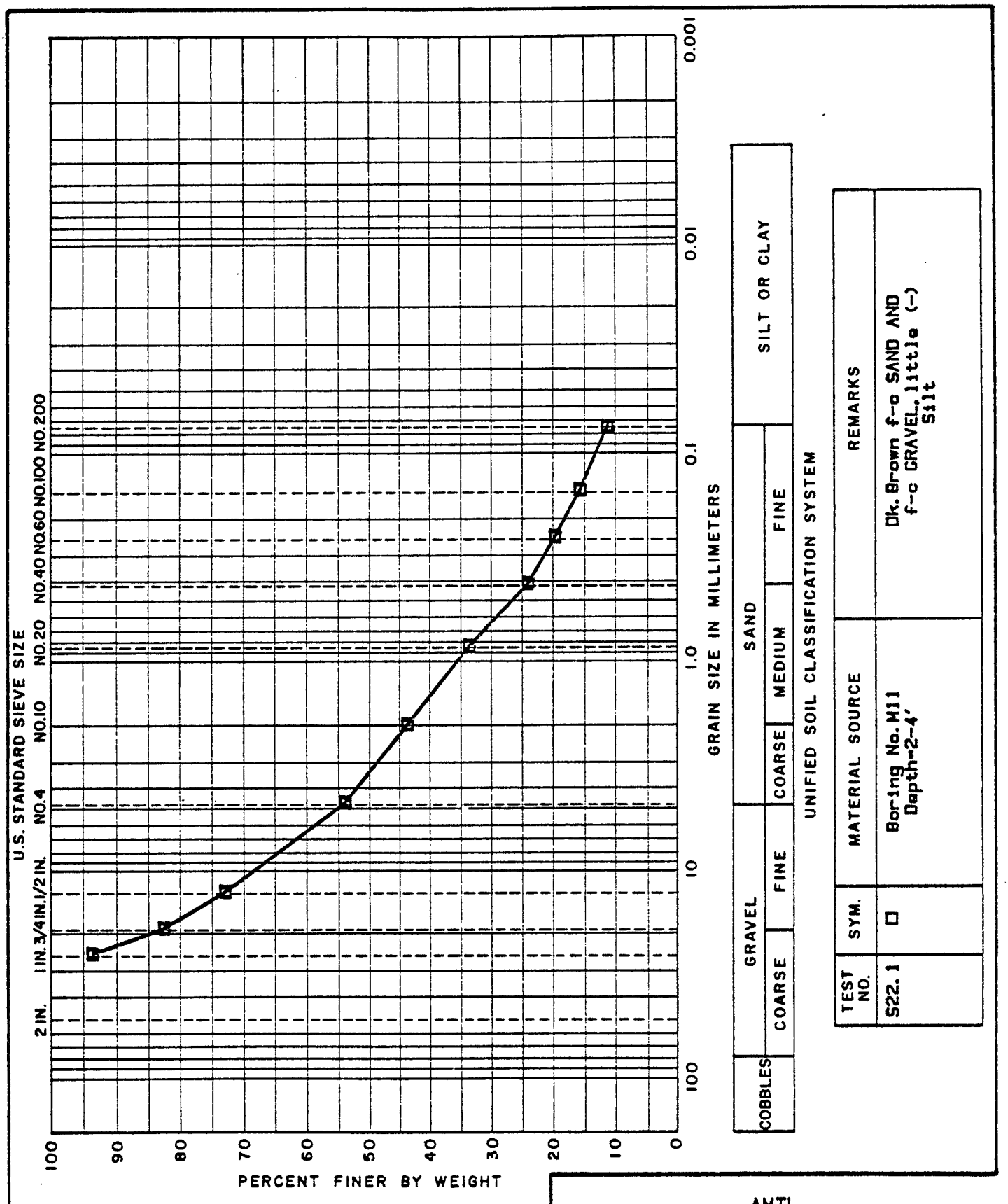
BORING NO. M10
SAMPLE
DEPTH 17-19'
TECH. MT
REVIEWER

TEST SERIES NO. 13
DATE Aug. 86
L10910

FILE

APPENDIX E-9

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



AMTL

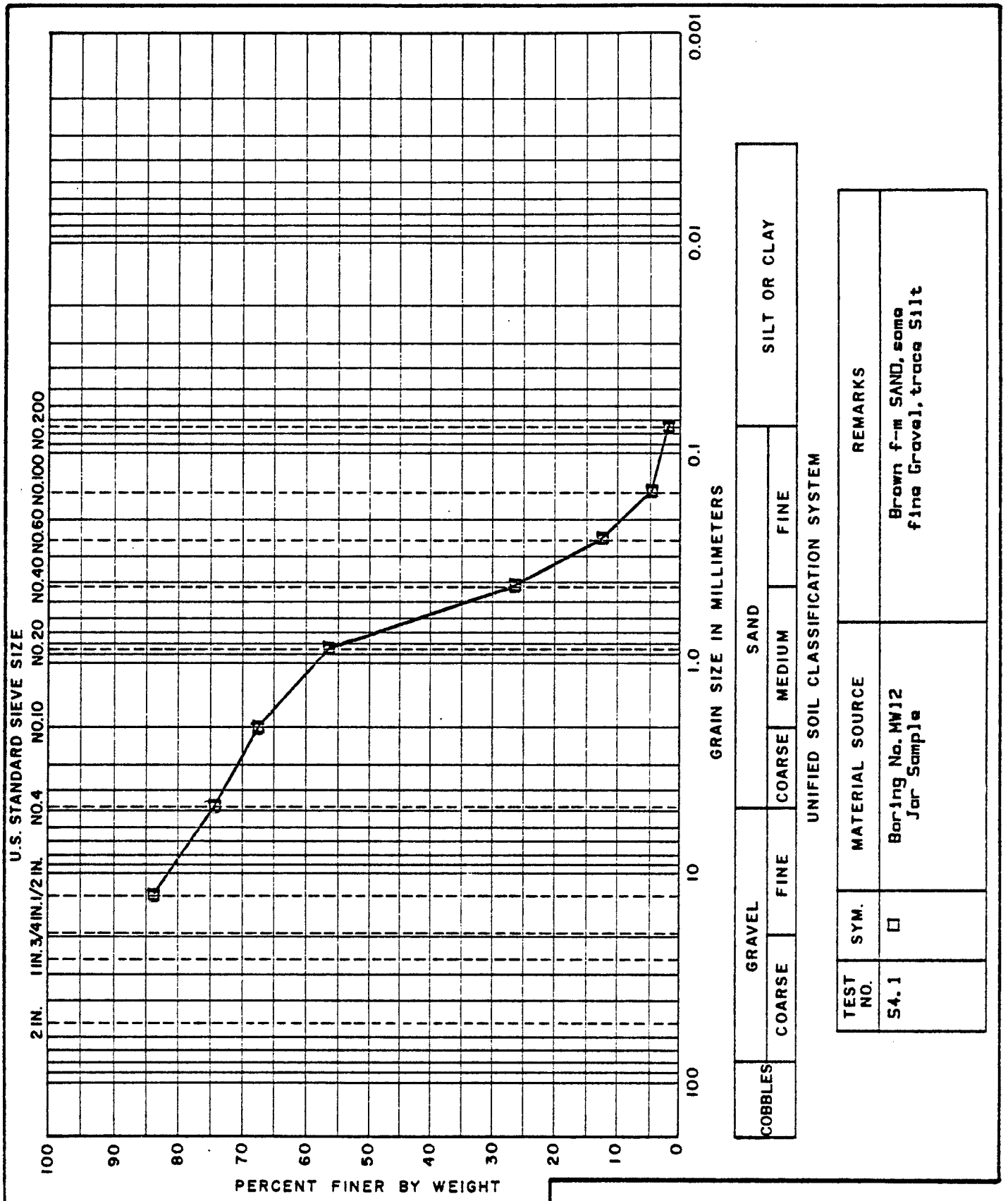
WATERTOWN, MASS

GRADATION TESTS

BORING NO. M11
SAMPLE
DEPTH 2-4'
TECH. MT
REVIEWER

TEST SERIES NO. 22
DATE Aug. 88
L10810

FILE



AMTL

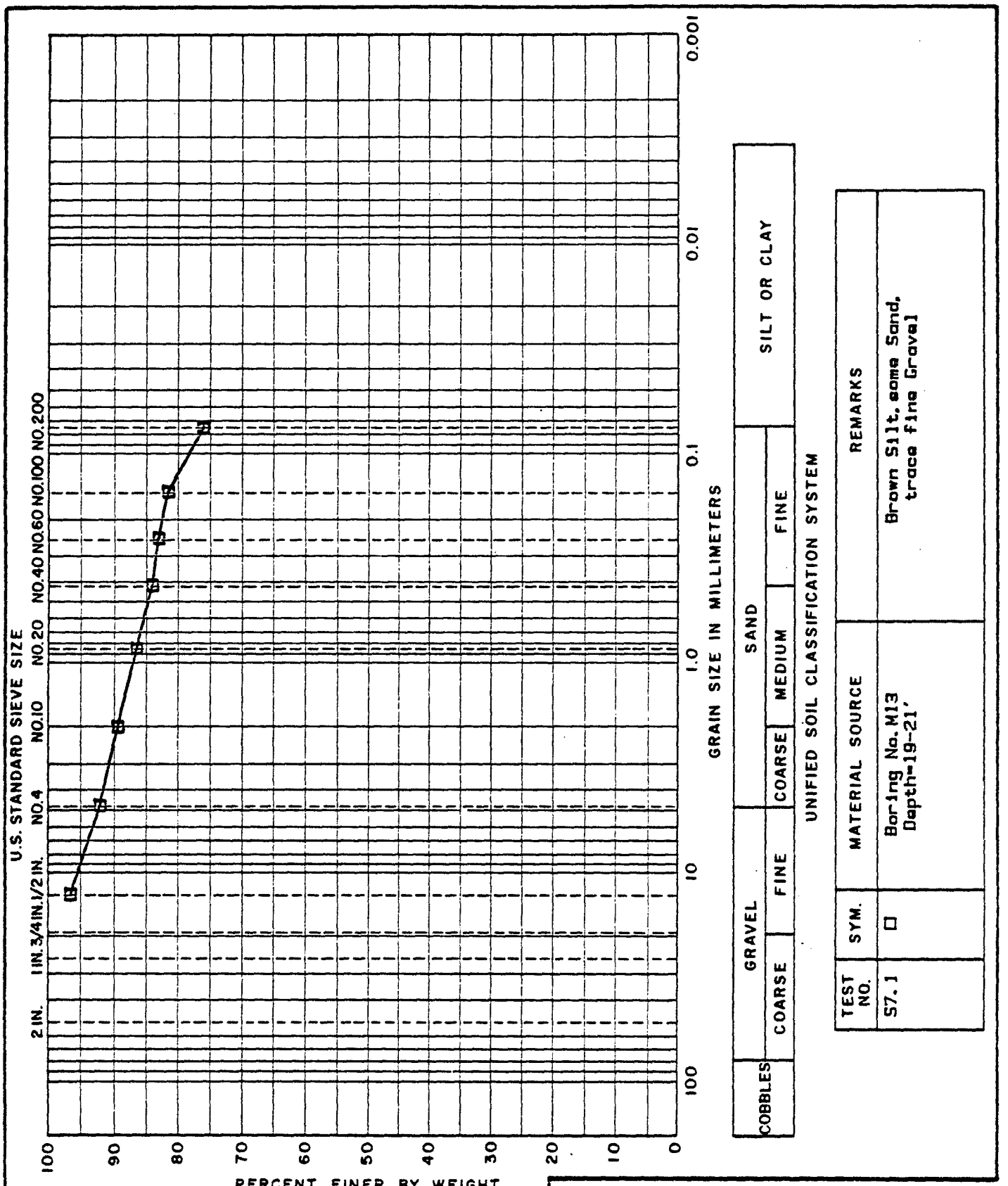
WATERTOWN, MASS

GRADATION TESTS

BORING NO. MW12
SAMPLE
DEPTH 12-14'
TECH. MT
REVIEWER

TEST SERIES NO. 4
DATE June 88
L10810

FILE



AMTL

WATERTOWN, MASS

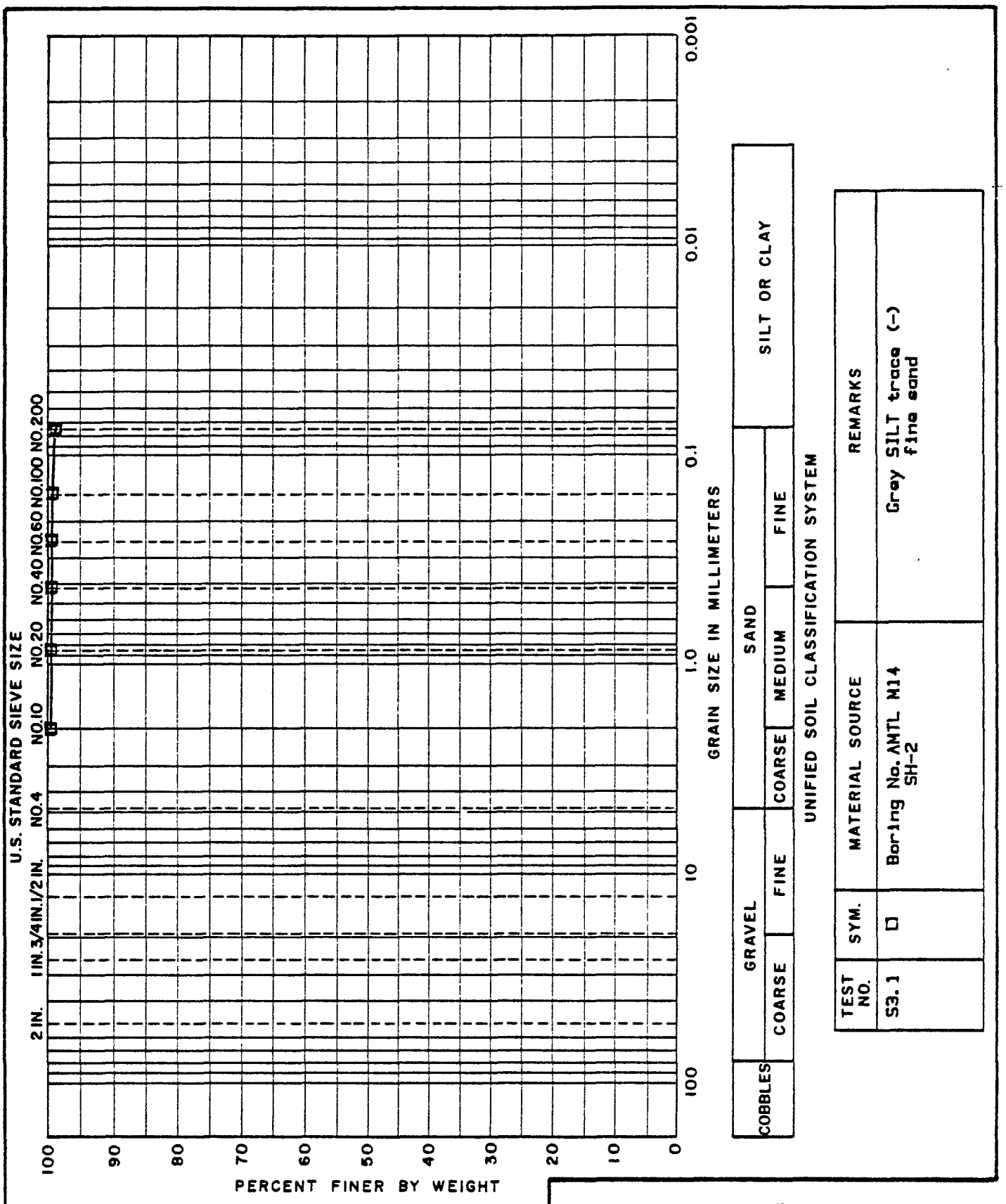
GRADATION TESTS

BORING NO. M13
SAMPLE
DEPTH 19-21'
TECH. MT
REVIEWER

TEST SERIES NO. 7
DATE Aug. 88
L10910

FILE

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



AMTL

WATERTOWN, MASS

GRADATION TESTS

BORING NO. M14
SAMPLE
DEPTH 16-18'
TECH. MT
REVIEWER

TEST SERIES NO. 3
DATE June 88
L10910

FILE

APPENDIX E-9

S.3

APPENDIX H

Survey Data

CORDINATES AND ELEVATIONS ARE ON THE U.S.G.S. SYSTEM

ELEVATIO
TAKEN C
AND 2.4

DESIGN STATE SURVEY, INC.
265 MEDFORD STREET
SOMERVILLE, MA. 02143
617-623-8881

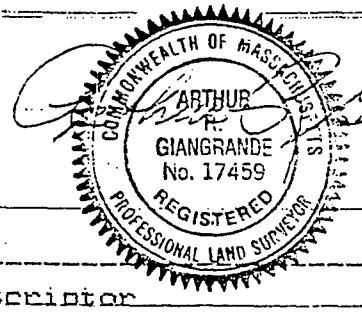
Coordinate File: 388165.CRD

List of Coordinate Points

RIM OF WELL

Point ID	NORTH	EAST	ELEV	Descriptor
1	498725.5400	686842.8100	**	USC&GS 89AD
2	498853.4800	687772.1200	**	USC&GS 89BE
3	498914.8463	687957.3598	**	PT"A" DH SET
4	498509.8611	688324.0971	**	PT"B" DH SET
5	498120.8737	688603.4942	**	PT"C" DH SET
6	497655.1389	689169.2046	**	PT"D" DH SET
7	497324.1203	689982.5551	**	PT"E" PK SET
8	497072.7060	690009.5561	**	PT"F" DH SET
9	497011.7554	690536.8853	**	PT"G" DH SET
10	497144.4787	689395.0231	**	PT"H" DH SET
11	497011.3949	689355.3548	**	POL LINE H-
12	496715.6723	689267.2087	**	PT"I" PK SET
13	496565.6041	689822.4772	**	PT"J" PK SET
14	496546.7047	690202.6377	**	PT"K" PK SET
15	496296.1599	690253.8242	**	PT"L" STK/NA
16	496170.9447	690286.6246	**	PT"M" STK/NA
17	496005.8919	690394.5751	**	PT"N" STK/NA
18	495851.7761	690595.5198	**	PT"O" STK/NA
19	495542.4487	691107.2432	**	PT"P" STK/NA
20	495685.1256	691198.6575	**	PT"Q" PK SET
21	496202.9785	690961.0552	**	PT"R" PK SET
22	496480.8885	690961.0672	**	POL LINE R-
23	496949.2785	690961.0874	**	PT"S" PK SET
24	497011.8277	690536.8639	**	CLOSING LINE
25	496493.1484	690207.5379	36.6300	WELL M-3
26	496324.1106	690227.9620	36.5200	WELL M-4
27	496019.9951	690398.0710	15.9300	WELL M-5
28	495920.7222	690564.7517	11.0100	WELL M-11
29	495601.7015	691115.3144	11.9600	WELL M-6
30	495588.0851	691130.3438	11.9000	WELL C-3
31	496643.8362	690929.4368	39.4800	WELL M-8
32	496095.4599	691019.7995	34.8400	WELL M-7
33	496492.2907	690788.1628	38.5200	WELL M-12
34	496410.7009	690680.2971	37.4900	WELL C-2
35	497123.3269	689471.6057	35.3000	WELL M-13
36	497161.2353	689112.5475	32.8600	WELL M-10
37	496981.5617	689378.6323	**	C-1, WELL NO
38	496984.6057	689369.1444	35.4900	WELL M-14
39	496697.9357	689273.1963	24.9800	WELL M-1
40	496604.2491	689670.0118	24.0400	WELL M-2
41	496986.3846	690557.2931	37.0300	WELL M-9

ELEVATIONS OF THE WATER LEVEL OF THE CHARLES RIVER TAKEN ON JULY 13, 1988 AT 11:45 AM. WAS 2.45 FEET AND 2.46 FEET AT A FIVE HUNDRED FOOT INTERVAL.



Arthur Giangrande

Descriptor
JSC&GS 89AD
JSC&GS 89AE
PT"A" DH SET
PT"B" DH SET
PT"C" DH SET
PT"D" DH SET
PT"E" PK SET
PT"F" DH SET
PT"G" DH SET
PT"H" DH SET
POL LINE H-I
PT"I" PK SET
PT"J" PK SET
PT"K" PK SET
PT"L" STK/NAIL SET
PT"M" STK/NAIL SET
PT"N" STK/NAIL SET
PT"O" STK/NAIL SET
PT"P" STK/NAIL SET
PT"Q" PK SET
PT"R" PK SET
POL LINE R-S PK SET
PT"S" PK SET
CLOSING LINE ON PT"G"
WELL M-3
WELL M-4
WELL M-5
WELL M-11
WELL M-6
WELL C-3
WELL M-8
WELL M-7
WELL M-12
WELL C-2
WELL M-13
WELL M-10
C-1, WELL NOT SET YET
WELL M-14
WELL M-1
WELL M-2
WELL M-9

Start COGO Traverse

Point	Descriptor		NORTH
9	PT"G" DH SET		497011.75
TRAVERSE from 9			
Inverse	N 83 22 12 W	1149.55 USFeet	
10	PT"H" DH SET		497144.47
Inverse	S 16 35 52 W	138.87 USFeet	
11	POL LINE H-I		497011.39
Inverse	S 16 35 52 W	308.58 USFeet	
12	PT"I" PK SET		496715.67
Inverse	S 74 52 35 E	575.19 USFeet	
13	PT"J" PK SET		496565.60
Inverse	S 87 09 14 E	380.63 USFeet	
14	PT"K" PK SET		496546.70
Inverse	S 11 32 48 E	255.72 USFeet	
15	PT"L" STK/NAIL SET		496296.1
Inverse	S 14 40 44 E	129.44 USFeet	
16	PT"M" STK/NAIL SET		496170.9
Inverse	S 33 11 10 E	197.22 USFeet	
17	PT"N" STK/NAIL SET		496005.8
Inverse	S 52 30 48 E	253.24 USFeet	
18	PT"O" STK/NAIL SET		495851.7
Inverse	S 58 50 52 E	597.95 USFeet	
19	PT"P" STK/NAIL SET		495542.4
Inverse	N 32 38 53 E	169.45 USFeet	
20	PT"Q" PK SET		495685.1
Inverse	N 24 38 48 W	569.76 USFeet	
21	PT"R" PK SET		496202.9
Inverse	N 00 00 09 E	277.91 USFeet	
22	POL LINE R-S PK SET		496480.8
Inverse	N 00 00 09 E	468.39 USFeet	
23	PT"S" PK SET		496949.2
Inverse	N 81 36 45 W	428.81 USFeet	
24	CLOSING LINE ON PT"G"		497011.8
Inverse	S 16 30 14 E	0.08 USFeet	
9	PT"G" DH SET		497011.7

Σ DISTANCE = 5900.71

LINEAL ERROR OF CLOSURE = 0.08

ERROR OF CLOSURE = $\frac{\Sigma \text{ DISTANCE}}{\text{LINEAL ERROR OF CLO}}$

NORTH	EAST
497011.7554	690536.8853
497144.4787	689395.0231
497011.3949	689355.3548
496715.6723	689267.2087
496565.6041	689822.4772
496546.7047	690202.6377
496296.1599	690253.8242
496170.9447	690286.6246
496005.8919	690394.5751
495851.7761	690595.5198
495542.4487	691107.2432
495685.1256	691198.6575
496202.9785	690961.0552
496480.8885	690961.0672
496949.2785	690961.0874
497011.8277	690536.8639
497011.7554	690536.8853

OF CLOSURE = 5900.71 / 0.08 = 1:73,758.88

I. Chain of Custody

APPENDIX I

Chain of Custody

Arthur D. Little, Inc.

CHAIN OF CUSTODY RECORD

PROJ. NO. | PROJECT NAME: AMTL, Watertown

SAMPLERS: *(Signature)*

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	VOA	Organics	Radiological	Metals					Remarks	SAMPLE CONDITION UPON RECEIPT
AMTL-508	5/31	1150	S			ice	X								40 ml	
AMTL-509	5/31	1156	S			ice	X								40 ml	
AMTL-510	5/31	1150	S			ice		X							250 ml	
AMTL-511	5/31	1156	S			ice		X							250 ml	
AMTL-512	5/31	1150	S			ice			X						250 ml	
AMTL-513	5/31	1150	S			ice			X						250 ml	
AMTL-514	5/31	1150	S			ice				X					250 ml	
	Signature															
-	Copy on file -															

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Shipped to:
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)*	Date/Time / Carrier:

Distribution: Original Accompanies Shipment; Yellow Copy to Case Manager; Pink Copy for Field Files

Arthur D. Little, Inc. 25 Acorn Park, Cambridge, MA 02140 (617) 864-5770
Telex 921436 Tel-Fax (617) 661-1622

*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

Arthur D. Little, Inc.

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
61453	AMTL - Watertown

SAMPLERS: (Signature) Robert P. Odell (for Richard M Podleton

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: Metals	VOA's	Semivol's, Pest/PCB's	Metals, CN, Sulfide	Radiology, Total Uranium	Remarks	SAMPLE CONDITION UPON RECEIPT
AMTL-012	5/23/88	11:05	S		M12	ice	✓						
AMTL-013	5-23-88	11:05	S		M12	ice		✓					
AMTL-014	5-23-88	11:05	S		M12	ice		✓					
AMTL-018	5-25-88	10:05	S		M09	ice	✓						
AMTL-019	5-25-88	10:05	S		M09	ice		✓					
AMTL-020	5-25-88	10:05	S		M09	ice		✓					
AMTL-026	5-25-88	09:50	S		~~M09~~ C02	ice				✓			
AMTL-027	"	"	S		C02	"				✓			
AMTL-028	"	"	S		C02	"			✓				
AMTL-029	"	"	S		C02	"			✓				
AMTL-030	"	"	S		C02	"				✓			
AMTL-031	"	"	S		C02	"				✓			
AMTL-032	"	"	S		C02	"			✓				
AMTL-033	"	"	S		C02	"			✓				

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Robert Podell	5/25/88 17:15		Metatrace, Inc 13715 Rider Trail North Earth City, MO 63045
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time

Carrier: Fed Ex

Distribution: Original Accompanies Shipment; Yellow Copy to Case Manager; Pink Copy for Field Files

*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

Arthur D. Little, Inc. 25 Acorn Park, Cambridge, MA 02140 (617) 864-5770
Telex 921436 Tel-Fax (617) 661-1622

Arthur D. Little, Inc.

CHAIN OF CUSTODY RECORD

Page 1 of

PROJ. NO.	PROJECT NAME	SAMPLERS: (Signature)
	AMTL, WATERTOWN	Richard M. Pendleton

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	VOA's	Semivoa's, pesticides, PCB's	Metals (Cr, Sulfide						Remarks	SAMPLE CONDITION UPON RECEIPT
AMTL-530	6/15	1230	S			ice	✓									
AMTL-531	6/15	1230	S			ice	✓									
AMTL-532	6/15	1230	S			ice		✓							*Semivoa's, pesticides, PCB's + USATHAMA list	
AMTL-533	6/15	1230	S			ice		✓							" " " " "	
AMTL-534	6/15	1230	S			ice			✓							

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Richard M. Pendleton	6/15/88 1315	Alan W. Nangle	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier:

Distribution: Original Accompanies Shipment; Yellow Copy to Case Manager; Pink Copy for Field Files

Arthur D. Little, Inc. 25 Acorn Park, Cambridge, MA 02140 (617) 864-5770
Telex 921436 Tel-Fax (617) 661-1622

*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

Arthur D. Little, Inc.

CHAIN OF CUSTODY RECORD

PROJECT NO. | PROJECT NAME: AMTL - Watertown

SAMPLERS (Signature): [redacted]

SAMPLE NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA	Metals							Remarks	SAMPLE CONDITION UPON RECEIPT
AMTL-001	5/17/89	0715	S		MOL	ice	✓								NOT SHIPPED	
AMTL-002	5/17/89	0715	S		MOL	ice		✓							NOT SHIPPED	
AMTL-003	5/17/89	1230	S		MOL	ice	✓									
AMTL-004	5/17/89	1230	S		MOL	ice	✓									
AMTL-005	5/17/89	1230	S		MOL	ice		✓								

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
[redacted]	1700 / 5/18/89	Alan Mangle	MedaTrace, Inc. 13715 Rider Trail North Earth City, MO 63045 (314)-298-8566
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier:

Distribution: Original Accompanies Shipment; Yellow Copy to Case Manager; Pink Copy for Field Files

Arthur D. Little, Inc. 25 Acorn Park, Cambridge, MA 02140 (617) 864-5770
Telex 921436 Tel-Fax (617) 661-1622

*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

[redacted] Nu. [redacted] / [redacted] of [redacted] [redacted] [redacted] [redacted] [redacted] IN [redacted] CU [redacted] ODY [redacted] CO [redacted] Page 1 of 1

PROJ. NO.	PROJECT NAME	Analyses	Remarks	SAMPLE CONDITION UPON RECEIPT
	A.M.T.L. WATERTOWN, MA.			

SAMPLERS: *(Signature)* Amy N. Tarlton

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	VOA	METALS							
AMTL-006	5/19/88	8:45A	S		MW-14	Ice		✓							
AMTL-007	5/19/88	8:45A	S		MW-14	Ice	✓								
AMTL-008	5/19/88	8:45A	S		MW-14	Ice	✓								
AMTL-009	5/20/88	12:NOON	S		MW-02	Ice		✓							
AMTL-010	5/20/88	12:NOON	S		MW-02	Ice	✓								
AMTL-011	5/20/88	12:NOON	S		MW-02	Ice	✓								

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Shipped to:
Amy N. Tarlton	5/20/88 12:35P	R N Lamb	MEGA TRACE, INC. 13715 RIDER TRAIL NORTH EARTH CITY, MO. 63045 (314)-298-8566
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)*	Date/Time / Carrier:

Distribution: Original Accompanies Shipment; Yellow Copy to Case Manager; Pink Copy for Field Files

Arthur D. Little, Inc. 25 Acorn Park, Cambridge, MA 02140 (617) 864-5770
Telex 921436 Tel-Fax (617) 661-1622

*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

Arthur D. Little, Inc.

CHAIN OF CUSTODY RECORD

PROJECT NAME: APRIL WATERSHED

SAMPLERS (Signature): Richard M. Pellet

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA's	TOX / semi VOA's, pest-PCBs, Priority Pollutant compounds list	Radiological Analy.	Metals - Cn - Sulfide	Remarks	SAMPLE CONDITION UPON RECEIPT
APRIL-518	6/13	0900	XS			Ice	X				40 ml ice	
APRIL-517	"	"	XS			"	X				40 ml ice	
APRIL-520	"	"	XS			"		X			250 ml ice	
APRIL-521	"	"	XS			"		X			250 ml ice	
APRIL-522	"	"	XS			"			X		250 ml ice	
APRIL-523	"	"	XS			"			X		250 ml ice	
APRIL-524	"	"	XS			"				X	250 ml ice	
APRIL-525	"	0750	XS				X				40 ml	
APRIL-526	"	0750	XS				X				40 ml	
APRIL-527	"	0750	XS					X			250 ml	
APRIL-528	"	0750	XS					X			250 ml	
APRIL-529	"	0750	XS							X	250 ml	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Richard M. Pellet	6/13/88 1140	Alan W. Nangle	
Relinquished by (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier:

Distribution: Original Accompanies Shipment; Yellow Copy to Case Manager; Pink Copy for Field Files

Arthur D. Little, Inc. 25 Acorn Park, Cambridge, MA 02140 (617) 864-5770
Telex 921136 Tel-Fax (617) 661-1622

*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

[redacted] Arthur D. [redacted] tle,

CHAIN OF CUSTODY RECORD

PROJECT NO.

PROJECT NAME: AMTK, WATERTOWN

SAMPLERS (Signature): Richard M. Pollet

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: METALS	Analyses: VOA's	Remarks
[illegible] 915	6/9	1120	✓		MW-4	ice	X		
[illegible] 916	6/9	1120	✓		MW-4	ice		X	
[illegible] 917	6/9	1120	✓		MW-4	ice		X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Richard M. Pollet	6/10/88 1105	Christopher R Mark	Metatrace Inc. 13715 Rider Trail North Earth City, MO 63045 Attn: Molly Martin
Relinquished by: (Signature) Christopher R Mark	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier: Fed Ex.

Distribution: Original Accompanies Shipment; Yellow Copy to Case Manager; Pink Copy for Field Files

Arthur D. Little, Inc. 25 Acorn Park, Cambridge, MA 02140 (617) 864-5770
Telex 921436 Tel-Fax (617) 661-1622

*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

[redacted] of [redacted] CHAIN [redacted] CUSTODY [redacted] Page 1 of [redacted]

PROJECT NO.

PROJECT NAME: AMTL Watertown, MA.

SAMPLERS: (Signature)

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA	SEMS VOA, PESTICIDES, PCB, NAPTHAMA COMPOUNDS	RADIOLOGICAL	METALS, CN, SULFIDES	BTEX	Remarks	SAMPLE CONDITION UPON RECEIPT
[redacted]-043	6/12/88	8:05	✓		MW-05	Ice	✓						
[redacted]-044	6/12/88	8:20	✓		MW-05	Ice	✓						
[redacted]-045	6/12/88	8:45	✓		MW-05	Ice		✓					
[redacted]-046	6/12/88	9:05	✓		MW-05	Ice		✓					
[redacted]-047	6/13/88	8:30	✓		MW-05	Ice			✓				
[redacted]-048	6/13/88	8:20	✓		MW-05	Ice			✓				
[redacted]-049	6/13/88	8:20	✓		MW-05	Ice				✓			
[redacted]-050	6/13/88		✓		MW-05	Ice						Not Taken Q.T.	
[redacted]-051	6/13/88		✓		MW-05	Ice						Not Taken Q.T.	
[redacted]-052	6/13/88		✓		MW-05	Ice						Not Taken Q.T.	

Relinquished by: (Signature)

Date/Time: 6/13/88 2:00

Received by: (Signature) Ellen W. Naugle

Relinquished by: (Signature)

Date/Time

Received by: (Signature)

Relinquished by: (Signature)

Date/Time

Received for Laboratory by: (Signature)

Date/Time

Shipped to:

Carrier:

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Arthur D. Little, Inc. 25 Acorn Park, Cambridge, MA 02140 (617) 864-5770
Telex 921436 Tel-Fax (617) 661-1622

*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

Arthur D. Little, Inc.

CHAIN OF CUSTODY RECORD

PROJ. NO. 61453

PROJECT NAME: AMTL - Watertown

SAMPLERS: (Signature) Robert P. Child (for Jeff Forthen and Richard Pendleton)

STATION NUMBER	DATE	TIME	COMP*	GRAB*	STATION LOCATION	PRESERVATION	Analyses: VOA's	METALS	Semivols, pesticides, PCBs and Volatile Aromatics	Metals-CN-Sulfide	Radiological (Analysis)	Remarks	SAMPLE CONDITION UPON RECEIPT
AMTL-034	5/26/88	2:10 p	✓		MOB	Ice	✓						
AMTL-035	5/26/88	2:10 p	✓		MOB	Ice	✓						
AMTL-036	5/26/88	2:10 p	✓		MOB	Ice		✓					
AMTL-501	5/27/88	8:30	✓		CØ2	"	X					Analyte sample 501-507 collected By Richmond (ADL	
AMTL-502	5/27/88	8:30	✓		CØ2	"	X						
AMTL-503	"	8:30	✓		CØ2	"			X				
AMTL-504	"	8:30	✓		CØ2	"			X				
AMTL-505	"	8:30	✓		CØ2	"					X		
AMTL-506	"	8:30	✓		CØ2	"					X		
AMTL-507	"	8:30	✓		CØ2	"				X			
			↑										
			Soils										

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Arthur J. Tarbell	5/27/88 11:48	Robert P. Child	Metatrace, INC 13715 Rider Trail North Earth City, MO 63045 314-298-8566
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier:

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[redacted]er N[redacted]r: [redacted] of [redacted]

Arthur D. Little, Inc.

Page [redacted] of [redacted]

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	SAMPLERS: (Signature)
	AMTL Watertown, MA.	Amy J. Foster

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA	Analyses: METALS	Remarks	SAMPLE CONDITION UPON RECEIPT
AMTL-053	6/15/88	9:05	✓		MW-07	Ice	✓			
AMTL-054	6/15/88	9:05	✓		MW-07	Ice	✓			
AMTL-055	6/15/88	9:05	✓		MW-07	Ice		✓		

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Amy J. Foster	6/15/88 1:15	Alec W. Naugle	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier:

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Arthur D. Little, Inc.

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	SAMPLERS: (Signature)
	AMTL WATERTOWN, MA.	

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA's	Analyses: METALS	Remarks	SAMPLE CONDITION UPON RECEIPT
AMTL-056	6/16/88	12:57	✓		MW-08	Ice	✓			
AMTL-057	6/16/88	12:57	✓		MW-08	Ice	✓			
AMTL-058	6/16/88	12:57	✓		MW-08	Ice		✓		

Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	6/16/88 1115	Alec W. Naugle
Alec W. Naugle	6/16/88 1345	[signature]
[signature]	6/16/88 2:30	Received for Laboratory by: (Signature)

Shipped to:

Date/Time

Carrier:

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Cooler Number: ____ of ____ [redacted] Page 1 of 1

CHAIN OF CUSTODY RECORD

PROJ NO.

PROJECT NAME: AMTL Watertown, MA.

SAMPLERS: (Signature)

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: METALS	Analyses: VOA	Remarks	SAMPLE CONDITION UPON RECEIPT
AMTL-037	5/31/88		✓		MW-10	Ice	✓			
AMTL-038	5/31/88		✓		MW-10	Ice		✓		
AMTL-039	5/31/88		✓		MW-10	Ice		✓		

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
[signature]	6/1/88 7:45	[signature]	Metatrace Inc. ATTN: Molly Martin 13715 Rider Trail North Earth City MO 63045
[signature]	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier: Fed. Ex.

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W - Water S - Soil LW - Liquid Waste SW - Solid Waste

Cooler Number: _____ of _____ [redacted] Page _____ of _____

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	SAMPLERS: (Signature)
	AMTL Watertown, MA.	Jeff N. Fort

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA	Analyses: METALS	Remarks	SAMPLE CONDITION UPON RECEIPT
AMTL-050	6/14/88	10:40	✓		MW-11	Ice	✓			
AMTL-051	6/14/88	10:40	✓		MW-11	Ice	✓			
AMTL-052	6/14/88	10:40	✓		MW-11	Ice		✓		

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Jeff N. Fort	6/14/88 10:50	Robert Pahl	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier:

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*Letter denotes sample matrix
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[redacted] of [redacted] CHAIN [redacted] CUSTODY RECO[redacted] [redacted] of [redacted]

PROJECT NO.	PROJECT NAME						Analyses								Remarks	SAMPLE CONDITION UPON RECEIPT
	[redacted] Acton, MA.						VOA	METALS								
SAMPLERS (Signature)																
STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION										
[redacted]	6/[redacted]/[redacted]	[redacted]	✓		MP-13	Ice	✓									
[redacted]	6/[redacted]/[redacted]	[redacted]	✓		MP-13	Ice	✓									
[redacted]	6/[redacted]/[redacted]	[redacted]	✓		MP-13	Ice		✓								

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Shipped to:
[redacted]	6/[redacted]/[redacted] 11:07	[redacted]	Metatrace Inc 13715 Rider Trail North Earth City, MO 63045 ATTN: Molly Martin
Relinquished by: (Signature) [redacted]	Date / Time	Received by: (Signature)	
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time / Carrier: Fed Ex

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*Letter denotes sample matrix
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Cooler Number: [redacted] of [redacted]

[redacted] Arthur D. Little, Inc. [redacted]

Page [redacted] of [redacted]

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
11453	Watertown Study

SAMPLERS: (Signature) Robert Pickel

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA's	Semi Volatiles	Pesticides/PCB's	Remarks	SAMPLE CONDITION UPON RECEIPT
M14V1	7/7/88	18:00		W			X				
M14V2	"	"		W			X				
M14SV	"	"		W				X			
M14M	"	"		W		HNO3 to pH<2			X		
M12V1	7/7/88	18:10		W			X				
M12V2	7/7/88	"		W			X				
M12SV	"	"		W				X			
M12M	"	"		W		HNO3 to pH<2			X		
M24V1	7/8/88	9:30		W			X				
M24V2	"	"		W			X				
M24SV	"	"		W				X			
M24M	"	"		W		HNO3 to pH<2			X		

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Robert Pickel	7/8/88 7:30 pm		MOLLY MARTIN METHTRACE 13715 RIDER TRAIL N. EARTH CITY, MO 63045
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier:

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*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

Cooler Number: [redacted] of [redacted] — [redacted] Arthur D. Little, Inc. — [redacted] Page [redacted] of [redacted]

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
61453	Watertown Mall

SAMPLERS: (Signature) R. Olif

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA's	Semi VOA's	Metals							Remarks	SAMPLE CONDITION UPON RECEIPT
[redacted]7V1	7/18	14:52		W			X										
[redacted]7V2	"	"		W			X										
[redacted]7SV	"	"		W				X									
[redacted]7M	"	"		W		HNO3 to pH<2			X								
~~[redacted]9V1~~	~~7/18~~																
[redacted]3V1	7/18	[redacted]		W			X										
[redacted]3V2	"	"		W			X										
[redacted]3SV	"	"		W				X									
[redacted]3M	"	"		W		HNO3 to pH<2			X								
[redacted]10V1	"	17:45		W			X										
[redacted]10V2	"	"		W			X										
[redacted]10SV	"	"		W				X									
[redacted]10M	"	"		W		HNO3 to pH<2			X								

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Robert Olif	7/18/88 17:30		Alpha Analytical 13715 Rothdrum Way Suite I Chantilly VA 22021
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier:

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Telex 921436 Tel-Fax (617) 661-1622

*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

[redacted] Arthur D. Little, Inc.

CHAIN OF CUSTODY RECORD

PROJ. NO. 1453

PROJECT NAME: Waterfront - Mun L

SAMPLERS: (Signature)

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA'S	Semi-Volatiles	Metals - dissolved	Remarks	SAMPLE CONDITION UPON RECEIPT
MW1V1	7/6/88	11:00		W			X				
MW1V2	"	"		W			X				
MW1SV	"	"		W				X			
MW1M	"	"		W		HNO_3 to pH<2			X		
MW5V1	"	12:45		W			X				
MW5V2	"	"		W			X				
MW5SV	"	"		W				X			
MW5M	"	"		W		HNO_3 to pH<2			X		
MW3V1	"	1600		W			X				
MW3V2	"	"		W			X				
MW3SV	"	"		W				X			
MW3M	"	"		W		HNO_3 to pH<2			X		
TB1V1	"	1830		W			X				

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
[signature]	7/6/88 7:30 pm		Molly Martin Metafrace 13715 Rich Trail N Earth City MO 63045
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier: Fed Ex

Distribution: Original Accompanies Shipment; Yellow Copy to Case Manager; Pink Copy for Field Files

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*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

Cooler Number: 2 of 4 Arthur D. Little, Inc. Page 2 of 2

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
61453	Watertown - AMTL

SAMPLERS: (Signature) Joseph P. Moriarty

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA's	Semi-volatiles	Metals-dissolved						Remarks	SAMPLE CONDITION UPON RECEIPT
M22V1	7/6/88	1800		W			X									
M22V2	"	"		W			X									
M22SV	"	"		W				X								
M22M	"	"		W		HNO3 to pH<2			X							

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Joseph P. Moriarty	7/6/88 1430		Molly Martin Metatrace 1715 Rider Trail North Earth City, MO 63045
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier: Fed Ex

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*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

Cooler Number: 1 of 4

CHAIN OF CUSTODY RECORD

Page _____ of _____

PROJ. NO.	PROJECT NAME
6143	Watertown

SAMPLERS: *(Signature)*

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses	Remarks	SAMPLE CONDITION UPON RECEIPT
MW8V1	7/5/88	11:15		W			X		
MW8V2	7/6/88	11:15		W			X		
MW8SV	"	"		W			X		
MW8M	"	"		W		HNO3 to pH<2	X		
TB2V	7/6/88	14:10		W			X		
MW2V1		11:30		W					
MW2V2		11:35		W					
MW2SV				W					
MW2M				W		HNO3 to pH<2			
MW2V1	7/6/88	17:30		W				Sample was slightly silty 4 Hrs Purged at 1 liter/min	
MW2V2				W					
MW2SV	"	"		W					
MW2M	"	"		W		HNO3 to pH<2		Sample collected from 4 Hrs purged at 1 liter/min	

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Shipped to:
Robert D. Little	7/8/88 7:30 PM		Metcalf & Eddy 1371 Beacon Street Brookline, MA 02146
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)*	Date/Time / Carrier: Fed Ex

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*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

Cooler Number: ___ of 4 — Arthur D. Little, Inc.

Page 1 of 2

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
61453	Watertown, MA, YL

SAMPLERS: (Signature) Robert Reilly

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA's	Semi Volatiles	Dissolved Metals							Remarks	SAMPLE CONDITION UPON RECEIPT
MW23V1	7/7/88	9:15		W			X										
MW23V2	"	"		W			X										
MW23SV	"	"		W				X									
MW23M	"	"		W		HNO3 to pH<2			X									
MW6V1	"	11:30		W			X										
MW6V2	"	"		W			X										
MW6SV	"	"		W				X									
MW6M	"	"		W		HNO3 to pH<2			X									
MW9V1	"	13:50		W			X										
MW9V2	"	"		W			X										
MW9SV	"	"		W				X									
MW9M	"	"		W		HNO3 to pH<2			X									

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Robert Reilly	7/8/88 19:30		Molly MARTIN Metatrace 13715 Ridge Trail N. Earth City, MO 63045
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier:

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W - Water S - Soil LW - Liquid Waste SW - Solid Waste

Cooler Number: 2 of 4

Arthur D. Little, Inc.

Page 2 of 2

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
11453	Watertown Mall

SAMPLERS: (Signature) Robert Parker

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA's	Semi. VOA's	Dissolved Metals						Remarks	SAMPLE CONDITION UPON RECEIPT
MW1	7/5/88	12:46		W			X									
MW2	"	"		W			X									
MW3	"	"		W				X								
MW4	"	"		W					X							

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Robert Parker	7/8/88 17:30		Molly Martin Metatrace 13715 River Trail N. Earth City, MO 63045
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier:

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*Letter denotes sample matrix
W - Water S - Soil LW - Liquid Waste SW - Solid Waste

Cooler Number: 1 of 2 — Arthur D. Little, Inc.

Page _____ of _____

CHAIN OF CUSTODY RECORD

PROJ. NO.: 61453

PROJECT NAME: Watertown Arsenal

SAMPLERS: (Signature) Robert P. Ackel

STATION NUMBER	DATE	TIME	*COMP	*GRAB	STATION LOCATION	PRESERVATION	Analyses: VOA's	Semi-Volatiles	Dissolved Metals	Remarks	SAMPLE CONDITION UPON RECEIPT
MΦ3V1	7/5/88	1525		X			X				
MΦ3V2	7/5/88	1525		X			X				
MΦ3SV1	7/5/88	1525		X				X			
MΦ3M	7/5/88	1525		X		HNO_3 + H_2O_2			X		
MΦ4V1	"	11:58		X			X				
MΦ4V2	"	"		X			X				
MΦ4SV	"	"		X				X			
MΦ4M filtered	"	"		X		HNO_3 to pH < 2			X		
MΦ21V1	7/5/88	12:32		X			X				
MΦ21V2	"	"		X			X				
MΦ21SV	"	"		X				X			
MΦ21M	"	"		X		HNO_3 + pH < 2			X	certify on sample bottle label	
	7/5/88				tabled w. Th Molly Martin						
					collected date — 7/5/88 Not 7/2/88						

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Shipped to:
Robert P. Ackel	7/6/88 7:30 PM		Molly Martin Metatrace 13715 Rider Trail N Earth City, MO 63045
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time / Carrier: Fed Ex

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